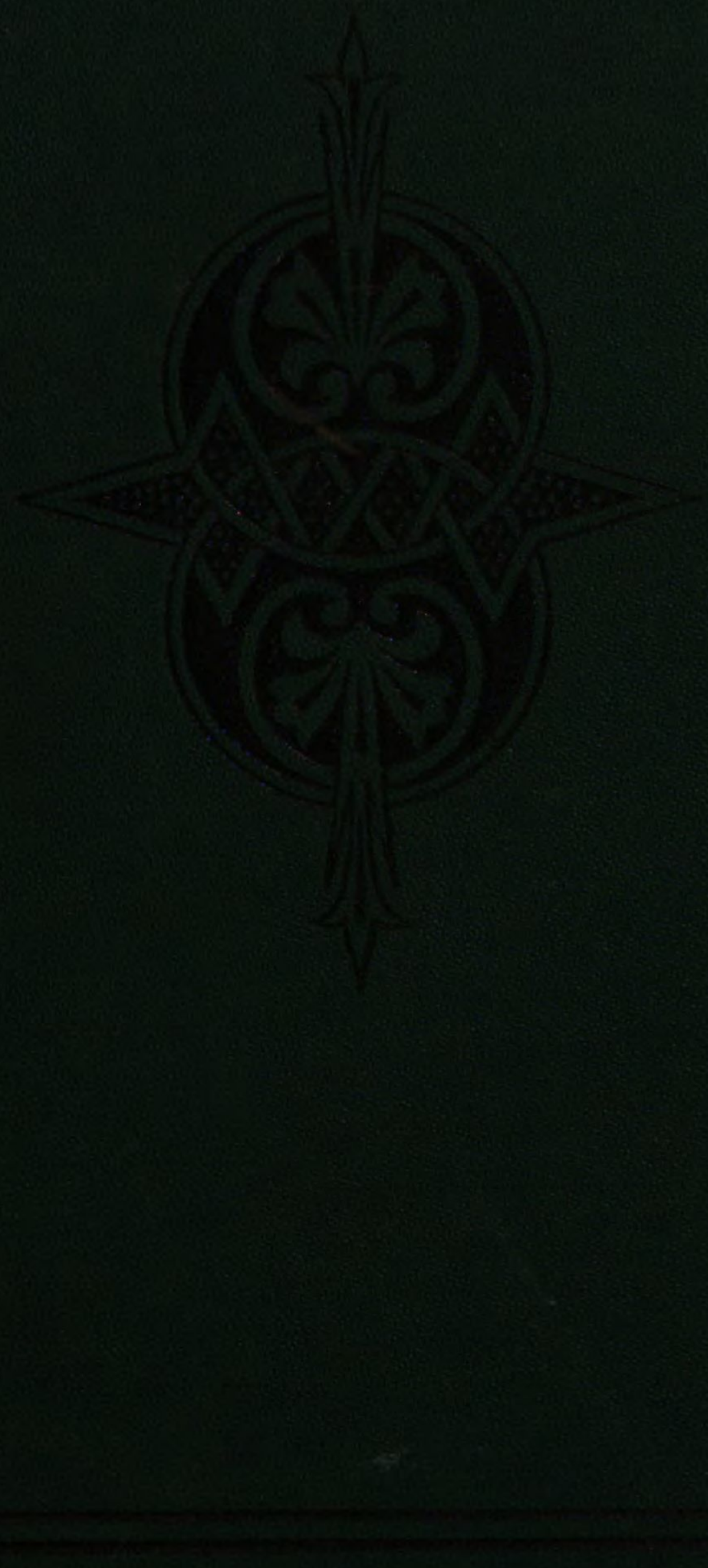

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Fleming

A MANUAL OF

VETERINARY SANITARY SCIENCE

AND POLICE:

EMBRACING THE NATURE, CAUSES, SYMPTOMS, ETC., AND THE PREVENTION, SUPPRESSION, THERAPEUTIC TREATMENT, AND RELATIONS TO THE PUBLIC HEALTH OF THE EPIZOÖTIC AND CONTAGIOUS DISEASES OF THE DOMESTICATED ANIMALS; WITH A SCHEME FOR A VETERINARY SANITARY ORGANIZATION, OBSERVATIONS ON THE DUTIES OF VETERINARY INSPECTORS, LEGISLATIVE MEASURES, INSPECTION OF MEAT AND MILK, SLAUGHTER-HOUSES, ETC.

AND AN APPENDIX CONTAINING THE CONTAGIOUS DISEASES (ANIMALS) ACT AND REGULATIONS.

BY

GEORGE FLEMING, F.R.G.S., ETC.,

Member of Council and of the Examining Board of the Royal College of Veterinary Surgeons;
Corresponding Member of the Central Veterinary Medical Society of Paris;
Veterinary Surgeon, Royal Engineers.

Author of "Horse-shoes and Horse-shoeing," "Animal Plagues," "Practical Horse-shoeing," "Rabies and Hydrophobia;" Translator and Editor of "Chauveau's Comparative Anatomy of the Domesticated Animals," &c.

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ERRATA.—(Vol. II.)

Page 36, line 8 from bottom, for "flat variolæ" insert "flat varioles."
,, 95, lines 2, 4, 11, and 18, for "variolæ" insert "varioles."
,, 398, line 2 from bottom, for "*Dermatophagus*," read "*Dermatophages*."

A MANUAL OF VETERINARY SANITARY SCIENCE.

STRANGLES.

SYNONYMS.—Technical: *Adenitis scropholosa equorum, Morbus glandulosus, Febra pyogenica, Adenitis equina.* English: *Strangles.* French: *Gourme.* German: *Druse, Kropf.* Italian: *Piccionaja, Barbone, Stranguglioni, Cimorro.*

GEOGRAPHICAL DISTRIBUTION.

This is probably a very widespread disease, being well-known on the European and American continents, as well as in Australia, Asia, and Africa. It is said to be somewhat rare in southern climates, as in Spain and Italy, and even in Southern Russia it is reported as unknown; and in France it is more common in the northern and central departments than elsewhere. It is unfrequent in Hungary; but prevails extensively in Germany, and in northern and western countries.

It is reported to be non-existent in Africa and Arabia, and in all those countries in which the Eastern horse, with its nervous temperament, is the only race. It is far from uncommon, however, at the Cape of Good Hope; but its existence there may be due to the fact that the horses are chiefly cross-bred from English stock, and that those of a sanguine and lymphatic temperament are most predisposed to it. It has been known from the earliest times.

CHARACTER.

Strangles is characterized by general febrile disturbance, a catarrhal inflammation of the membrane lining the upper air-passages, with swelling and suppuration of certain lymphatic glands, and a tendency to the formation of pus in different parts of the body.

NATURE.

Many opinions have been offered with regard to the nature of this disease. According to some authorities, it is a lymphatico-catarrhal malady of a scrofulous nature, peculiar to the horse ; others believe it to consist in a febrile acute inflammation or catarrh of the Schneiderian membrane, and that lining the frontal maxillary sinuses, with tumefaction and suppuration of the submaxillary glands ; while others, again, define it to be a contagious lymphatico-catarrhal equine disease, more particularly attacking young horses. It may be designated a constitutional predisposition, diathesis, or critical state peculiar to solipeds, and continuing from youth to adult age ; the pyogenic catarrhal fever which any accidental determining cause may occasion, being only the expression of this condition. Old horses, mules, and asses are rarely affected.*

The malady has some analogy to what is termed "distemper" in the dog.

CAUSES.

The age of the horse, as has been remarked, has a predisposing influence in the production of the disease, animals from two to five or six years of age being most liable to be affected. It may, however, attack foals or old horses ; but in these it does not present all its most characteristic features, and it does not give immunity to the former, as they may again suffer from strangles at the critical age ; while in adults, it scarcely differs from an ordinary angina or coryza. The predisposition is supposed to be owing to the blood of young horses containing a larger quantity of white globules than that of adults, in which the red globules predominate ; and that it is by the suppuration and catarrhal condition which characterize Strangles that the excess of leucocytes is got rid of, and the economy depurated. It appears to be well ascertained that if horses remain in the same conditions of hygiène, feeding, and labour

* Some French authorities have described what they designate "strangles" in the bovine and porcine species, but it is doubtful whether it has much affinity to this disease.

in which they have been reared, they are very often exempt from Strangles, or are affected with such a mild form that they are scarcely observed to be sick; but if these conditions are reversed, and during the critical age horses are transported suddenly from the region in which they are reared, and particularly if they are submitted to a change of temperature, food, and management, the disease is almost certain to appear. It is from this cause that we find troop remounts so liable to be attacked. Of horses affected with Strangles and sent to the Alfort Veterinary School, Paris, 88 per cent. were found to be newly purchased and imported from the breeding districts. Reynal has seen six hundred remounts, hurriedly purchased in foreign countries, and sent to the army corps, suffer, without an exception, from Strangles; and the same remark has been made in remount depots and regiments receiving new purchases—the disease appearing within a month after their arrival.

The diet has also, doubtless, some influence, in conjunction with emigration, in the production of the disease. Thus it is that dealers' horses, which are abundantly fed to make them fat, and kept in hot stables, are more susceptible than others; and those troop remounts which are chiefly fed on bran after joining their regiments, suffer almost without exception, and often severely.

Continental horse-dealers are well aware of this, and, according to Reynal, those who deal in young animals in Friesland (Holland), Hanover, and Oldenburg, journey those they have purchased off grass in troops by stages, feed them sparingly, and park them in the open air; experience having taught them that Strangles is less frequent and serious when the horses are managed in this way. In North Germany, the dealers buy large numbers of young horses, and drive them in lots of 100 or 150 to the principality of Hildeshaun and the duchy of Brunswick: each day travelling ten to fourteen miles, feeding them very moderately, and parking them out of doors like sheep, no matter what the weather may be. Change of season and atmospherical vicissitudes have likewise a large share in developing the malady. For this reason it is that it is more common in autumn and spring than in summer, or even winter.

Strangles frequently coincides with dentition and the replacement of the temporary by the permanent teeth; and this change has been looked upon as an occasional cause. According to Reynal, a kick, contusion, abrasion, or simple abscess, may be the cause of a strangles inflammation, which will precede the appearance of the malady in its ordinary form.

Contagion is also a cause of Strangles.

SYMPTOMS.

The disease is somewhat proteiform, and does not invariably offer the same symptoms in every case, these varying according to its mode of expression; but from the earliest times there has been distinguished a "benignant" and a "malignant" form of the malady.

1. *Benignant Strangles.*

Most frequently the disease is marked by symptoms, more or less acute, of complicated Angina, accompanied by a variable degree of fever, accelerated and irregular respiration, and cough. Generally there is nasal discharge, which is at first serous, then thicker, grayish in colour, and flaky; and there is tumefaction of the subglossal lymphatic and the parotid glands. This tumefaction sometimes subsides spontaneously; but most frequently it increases, and terminates by suppuration: abscesses invading the surrounding connective tissue, and containing laudable pus. This is the typical form of benignant Strangles, in which the acute stage lasts for four or five days, sometimes longer. When the pus has escaped from the abscess or abscesses, the symptoms of Angina gradually disappear, the animal suffers less, regains its appetite and liveliness, the cough diminishes, as does the discharge; and in some cases the horse has recovered its health in about fifteen days, and in others towards a month. External circumstances—such as temperature, atmospheric conditions, good food and stabling, as well as attention—influence the progress of the disease; while unfavourable circumstances readily bring about relapses, and the reappearance of sore throat, with more

abscesses. There are cases in which this formation of abscesses continues for months, notwithstanding every care. Sometimes after several weeks have elapsed, and when the health has apparently been completely re-established, the animal again falls sick, and abscesses form in the most varied parts of the body. This tendency to the formation of abscesses is characteristic of Strangles, and distinguishes it from simple Angina; it is generally considered a critical phenomenon of the disease, for unless the discharge is very great and compensates for purulence by its abundance, Strangles without an abscess always runs its course slowly and less favourably, and readily becomes complicated with disorders of the lungs and pleura, the animal suffering from anæmia. Not unfrequently, under the influence of this pyogenic inflammation, which is transmitted by continuity to the mucous membrane of the upper air-passages, purulent collections are formed in the guttural pouches and sinuses of the head.

Not unfrequently, also, at the very commencement there are external abscesses, which are sometimes superadded to the symptoms of Angina; at other times they are the only symptoms of Strangles. These abscesses may appear in various parts of the body, neck, shoulder, withers, wherever the harness may rest, as well as the breast, thigh, &c., and then always immediately beneath the skin; sometimes they also form more profoundly, as in the parotid and mesenteric glands, and even in the testicles and brain; then, of course, the disease is much more serious. In the vicinity of these abscesses, and usually about the head and neck, the lymphatic vessels, as well as the connective tissue surrounding them, not unfrequently become inflamed from the irritation set up in them by the altered lymph they convey; the glands receiving this lymph are tumefied in their turn, and sometimes suppurate. This condition of the lymphatics is only consecutive to the pyogenia, and has no direct relation to the disease itself. Care must be taken, however, not to mistake the nodulated vessels for those of Farcy; and the same caution is necessary with regard to the petechiæ, erosions, and superficial ulcerations sometimes observed on the pituitary membrane, and

which, to the inexperienced observer, might give rise to the belief that Glanders was present.

Cutaneous eruptions—Herpes, Eczema, &c., sometimes accompany the disease, and have led some authorities to consider it as exanthematous in its nature; but as these are not constantly present, and are not always of the same character, they cannot be looked upon as essential to the malady.

2. *Malignant Strangles.*

Malignant Strangles is that form which presents irregularities in its course, and diversity in its manifestations; these being so serious as to endanger life. The disease nearly always assumes this form when it appears in animals placed in unfavourable hygiènic conditions, badly fed and lodged, and debilitated by misery and fatigue. Their anæmic state is incompatible with the free development of the inflammation, the formation of laudable pus, and the normal course of the malady. The nasal discharge is of a bad character, scanty and often fetid, and the pituitary membrane pale or yellow in hue. The subglossal abscess does not maturate, but remains indolent; the animal loses condition and is "tucked-up," the coat becomes unhealthy and staring, and altogether there is a non-thriving appearance. This state may continue for months.

One of the most frequent complications is a psuedo-Pneumonia, in which the lungs are affected with passive congestion, and there is a tendency to pleuritic exudation, not unlike what occurs in typhoid Pneumonia. In some instances, there is Pleurisy without Pneumonia previously existing. Sometimes there are subcutaneous serous swellings, more or less generalized anasarca, often considerable œdema of the head, engorgement of the limbs, &c. Some animals are affected with intestinal Catarrh; at times there is true Enteritis, but more frequently there exists follicular irritation of the intestines which leads to dysenteric Diarrhœa. Tumours of various kinds appear on the shoulders, withers, chest, sides, &c., and these generally contain a large quantity of thin, badly-constituted pus; in many cases, nature does not appear to be

able to limit the extent of these tumours, and they are manifest as great diffused abscesses. In one case which had a fatal termination, I removed nearly a bucketful of thin sanious pus from an immense, unlimited, fluctuating swelling occupying the breast and shoulder.

There are also sometimes such complications as Arthritis, Synovitis, Orchitis, Ophthalmia, &c., due to the same causes; these are always very serious. Mention has also been made of a spasmodic form of Strangles occurring in nervous animals, and marked by fits of vertigo, nervous erethism, and in rare cases there is immobility.

It has been stated that malignant Strangles may degenerate into Glanders or Farcy; but without the presence of the contagium of these affections, it is scarcely possible to admit such a complication.

COURSE AND TERMINATIONS.

The course of benignant Strangles is, as a rule, regular, and seldom exceeds ten days; unless there is intense Angina and sublingual abscess, when it is longer, occupying from twenty to thirty days. Its termination is generally favourable, unless there are complications. The most frequent sequel, and one that occurs more particularly when the parotid glands have been involved, is "roaring."

The course and termination of malignant Strangles depends, of course, upon the gravity of the supervening complications. When the local lesions assume a chronic character, and abscesses appear periodically in various parts of the body, the disease may continue for two or three months, and even longer. When the lungs or pleura are affected, when the abscesses are numerous and of a bad character, and especially when they form internally, and when œdema is general, an unfavourable termination may be anticipated. The same result may follow when the upper air-passages and head are involved in œdema, and the respiration becomes stridulous. Death may then ensue from asphyxia. In some cases, the animals succumb to pyæmia, accompanied by the formation of lobular abscesses in the lungs; and in others there are

consecutive affections of a cachectic nature developed, such as mesentric Phthisis, Peritonitis, intestinal perforations, &c.

When abscesses form in the sinuses of the head, there is much trouble, and doubt as to the result : the discharge from the nostrils, continual or intermittent, often persisting for a long time, even when trephining has been resorted to.

PATHOLOGICAL ANATOMY.

The nature of the alterations is sufficiently indicated by the symptoms presented during life. The malady being of a pyogenic nature, purulent deposits in various regions are generally met with ; as well as inflammations, with exudations of lymph, and serous effusions. The lymphatic system is usually involved.

DIAGNOSIS.

The malady can scarcely be mistaken for any other. The age of the animal, its history, the nature of the discharge and the glandular tumefaction, the presence of Angina and Fever, and the absence of chancrous ulcers on the septum of the nose, should distinguish "strangles" from "glanders." The engorgement of the lymphatic vessels and glands of the face is distinguished from that of Farcy by the volume of the tumours, the œdematous inflammation, and the character of the morbid matter secreted. The purulent collections are rarely circumscribed in the connective tissue of the lips, and usually the pus infiltrates it as if it were a sponge ; and when it reaches the skin, it is evacuated by a multitude of small confluent openings, which soon form only one. The pus is thick and white, and not stringy and oily like that from the lymphatics in Farcy. The same remarks are applicable to the œdematous purulent engorgements observed on the course of the large lymphatic vessels of the limbs.

CONTAGIUM.

The contagiousness of Strangles was firmly believed in by the hippiatrists and veterinarians of the last century, and since denied by many authorities. But the clinical observa-

tions of those who are placed in the best position to study the malady, have demonstrated in the clearest manner that there exists a contagium, that this contributes to its propagation, and often causes it to become enzoötic in certain localities under particular circumstances. The facts are numerous in which a young horse suffering from the disease, has communicated it to other horses in the stable to which it has been introduced. Gohier, Toggia, and Reynal have also successfully inoculated healthy horses with the nasal discharge.

This contagium would appear to exist in the fixed and volatile conditions. Direct contact with a diseased horse is not necessary, the transmitted malady not always first attacking the animals which are nearest to it.

VITALITY OF THE VIRUS.

We have not sufficient evidence to enable us to arrive at any satisfactory conclusion as to the vitality of the contagium, but it is probable that its virulence is not very tenacious.

INFECTION.

The disease is most readily transmitted to young horses predisposed to receive the contagium; old horses, and those which have already been affected, being least susceptible. According to Charlier, bovine animals may become infected; he having observed it to be so transmitted to them in a badly ventilated, filthy stable, in which were diseased horses.

MODE OF INFECTION.

Infection usually takes place in hot, crowded stables, and through the association of healthy with diseased horses. It is not improbable that the contagium may be conveyed by forage and water, and dwellings in which affected animals have been kept may also transmit it.* Inoculation, as has been already mentioned, will also produce it.

* I remember that, some years ago, a particular stable in the cavalry barracks at Edinburgh was called the "strangles stable." The erroneous notion being then prevalent that it was necessary for horses to have the disease, remounts were always lodged therein, in order that they might become affected, which they nearly always were.

MODE OF ACCESS.

The contagium may obtain access through the air-passages; but we have not yet any evidence to show that it may enter by the digestive organs. Inoculation introduces it directly to the blood.

INCUBATION.

The latent period probably varies from one to three weeks.

EXTENSION.

Contagion may extend the malady until it becomes epizoötic. Young horses suffering from the malady cohabiting with other horses, or animals predisposed introduced into infected stables, propagate the disease.

MORTALITY AND LOSS.

The disease in some years, and in unfavourable circumstances, is often very troublesome and fatal. Even under the most favourable conditions, it entails a certain amount of risk; the most serious consecutive affection of a chronic nature being "roaring," which greatly depreciates the utility and value of horses.

IMMUNITY.

The old hippiatrists believed that one attack of the disease conferred immunity—consequently, that a horse was only once affected; and a large number of the most competent veterinary authorities maintain this opinion. Others, however, assert that it is not rare to see the malady, in various forms, appear three, and even four times in the same horse; and Zundel has witnessed it five and six times, and always as the result of contagion. Reynal observes that the idea that Strangles only attacks an animal once is rendered improbable by every day's experience, and that it is not rare to notice, during the changing of stations, young cavalry horses affected with diseases of the upper air and digestive passages, with discharge, and swelling of the submaxillary glands, the marked tendency of which to suppuration left no doubt as to the critical nature of the affection. And M. Riquet informed

him, that during his residence at Hamburg in 1848, he had frequently occasion to observe that the recently purchased horses were affected with Strangles; after their recovery they were sent to Hanover, and there the disease attacked them a second time; and when they reached their regiments in France, they had it a third time. Reynal made similar observations at the remount depot of Saint-Avold.

But it may be asked if the disease communicated to aged horses which have exceeded the critical period, is really Strangles. Zundel thinks it is not, and that it is merely a simple catarrhal affection—an Angina or a Coryza. Never in the aged horse is there the same profuseness of suppuration which characterizes the Strangles of the young animal, and which changes, we might say, the lymphatic into the sanguine temperament. Contagion can, therefore, only give rise to real Strangles in an animal already predisposed; otherwise, it only produces a Catarrh. As after the disease has once attacked an animal the predisposition disappears, it may therefore be admitted that it only attacks a horse once, and thus indirectly confers immunity.

SANITARY MEASURES.

The somewhat popular notion that Strangles is an inevitable disease, and is indeed necessary for the welfare of the horse, is absurd; no disease is necessary or inevitable. The fact that it is unknown among Eastern breeds, and those kept in the most natural conditions, is sufficient to disprove this. No doubt our climate, and our mode of rearing and managing the horse, appear to entail this malady upon it, and few escape; but we cannot admit that it confers any advantage upon the animal, nor that, with better management, it might not be prevented.

In view of the loss it may occasion, and its oftentimes serious results, even when the animal has recovered from its more severe effects, every care should be taken to prevent it, by keeping in mind the predisposing and exciting causes. When it does appear, it should be treated as a contagious

disease; though the intervention of the law may not be necessary. An animal so affected should not be placed in a stable with healthy horses, and a horse should not be sold when suffering from Strangles. Diseased horses should be isolated from those which are healthy; and stables and stalls, and particularly mangers, ought to be thoroughly cleansed and disinfected.

CURATIVE MEASURES.

In the treatment of this disease, proper hygiènic management is essential. A moderate, equable temperature; a substantial, easily-digested diet; plenty of bran or oatmeal gruel; and saline medicaments, such as cream of tartar, nitrate of potass, or the bicarbonate or sulphate of soda, may be given in this gruel. The malady having a debilitating tendency, the strength must not be impaired by medical treatment; it may be even necessary to give tonics and stimulants from an early period.

The submaxillary tumour may be hastened towards suppuration by fastening a piece of fresh sheep-skin around the head, and poulticing and blistering. The inhalation of hot water vapour, to which oil of turpentine has been added, accelerates the nasal discharge, and relieves Angina; and the same medicine, combined with alkalies and vegetable bitters, may be given when the discharge is not of a good character. There should be no hurry in opening the abscesses which form, and all complications ought to be treated according to the indications they offer.

INFLUENZA.

SYNONYMS.—A large number of very different diseases which may have chanced to prevail more or less extensively among horses at a given period, have been included under this designation. The synonyms are, consequently, as numerous as these maladies. We shall, therefore, dispense with their enumeration, as the term "influenza" is well understood in every modern language.

GEOGRAPHICAL DISTRIBUTION.

The malady is well known in Europe and on the American continent, but has not, so far as I can ascertain, been witnessed in Australia. I am not aware that it has been seen to any extent in Asia or Africa, if at all.* It has been known for some centuries in Europe, but the more extensive outbreaks have only been recorded for about two hundred years.† The great epizoöties have often coincided with Influenza in man. In this century it so appeared in 1803, 1805, 1833, and 1858. One of the most remarkable and best recorded invasions was that which appeared in Toronto, Canada, in September, 1872, and which, radiating thence in every direction, visited all the cities in Canada, spreading over the United States as

* In "Animal Plagues" I have described an interesting outbreak, which may have been "influenza," among horses in Yemen, Arabia, in A.D. 1328.

† The history of these invasions of Influenza up to the end of the last century will be found in "Animal Plagues." In that work, I have omitted to mention that Ozanam (Hist. Méd. Générale et Particulière des Maladies Epidémiques, &c.) alludes to an outbreak of Catarrh, which affected horses throughout Germany, Bohemia, and Moravia, in 1746; also that Huzard, sen., alludes to Influenza attacking horses in the spring of 1776, after the human species had been affected (Journal de Méd., vol. lix. p. 333).

far south as Virginia, and westerly to Chicago. Within two months it had invaded the states and territories of the Far West; it appeared in California, and, travelling onward, reached British Columbia, Cuba, Mexico, and Central America.

CHARACTER.

If we took into consideration the numerous descriptions of the epizoöties recorded, and said to be those of Influenza, it would indeed be difficult to assign a definite character to such a protean malady. But as a number of typhoid affections have been confounded with what must be distinguished as "influenza," and as these are characterized by a certain alteration in the blood, and in other respects bear some analogy to the Typhoid fever of man, we shall exclude them, and only notice the equine epizoötic malady, which, in every respect, is the analogue of human Influenza.

This disease is characterized by fever, some degree of inflammation, bronchial catarrh, general soreness, cough, nervous disturbance, and a remarkable degree of prostration, which cannot be accounted for by the suffering nor the local lesions observed. Some authorities have denied that Influenza has any special character, and consider it as a simple bronchial Catarrh, or an ordinary Pleurisy; but the nervous derangement which accompanies it, and the disproportion between the thoracic and other morbid phenomena, are sufficient to establish a wide difference between them. The disease must not be confounded, as has been so frequently done, with the nasal Catarrh which, attacking horses in the spring and autumn, sometimes attains the dimensions of an epizoöty, and appears to be contagious.

NATURE.

Influenza is an essentially specific epizoötic disease, affecting animals of all ages and breeds, and in all conditions of hygiène and management. In some outbreaks it is in its nature sthenic, in others asthenic; sometimes it is accompanied by nervous excitement, at other times by torpidity; but it always bears a special character. Its contagiousness has been

denied and affirmed by the best authorities; but, as Zundel remarks, the epizoötic typhoid maladies with which it has been so frequently confounded, and which are undoubtedly contagious, may have led to its being regarded as transmissible from sick to healthy animals. Its contagiousness, however, is sometimes more than probable. In its most usual form, it is in its essence a special Catarrhal fever, in which the nervous centres are involved; and it attacks all, or nearly all, soliped animals in a country, appearing suddenly, and almost as quickly subsiding.

CAUSES.

We know nothing for certain of the cause or causes of Influenza. It appears in the most diverse climates and at all temperatures; though it is generally more frequent in the spring and autumn than at other seasons. The latest and closest observations show that it does not spread by virtue of any of the recognized atmospheric conditions of cold, heat, humidity, season, climate, or altitude. In the recent epizoöty in America, it prevailed and was propagated in the cold of a northern winter, and in the summer heat of Central America; in the dry air of Minnesota, and in the moist air of the seaboard; at an altitude of five thousand feet above the sea (at Saltillo, Mexico), and on the low levels of New Orleans (ten feet above sea-level) and Galveston (five feet above sea-level). Many causes, some of them of the most dissimilar character, have been ascribed as operat*ing* in the production of the disease; but to none of them can this power be satisfactorily attributed. The air has been admitted by the majority of authorities to be the most potent agent in disseminating the malady, through its conveying a miasma. Gleisberg believes its development to be due to a special electrical condition of the atmosphere, or to its containing an unusual proportion of ozone, which is capable of irritating the air-passages, and occasioning bronchial Catarrh and other thoracic affections. It has often been noticed that, in our hemisphere, it is those countries which are exposed to

north or east winds which are most frequently visited by Influenza, and these winds are said to be richest in ozone ; while the disease has been observed to disappear, or to be averted by the west wind, which, after traversing the surface of the ocean, is poor in this modified oxygen. Recent investigation shows, however, that the manner in which the disease extends is opposed to this view of dissemination by winds, and that the malady spreads by virtue of its communicability ; of this there is logical proof, though it has not been experimentally demonstrated. In the American outbreak of 1872-73, it commenced at Toronto, and spread thence as from a centre, no locality being exempt which was known to have been in communication, by means of horses or mules, with places in which the disease existed ; and those places which were not visited by it were so situated that the importation of horses or mules was in some of them impossible, and in others of them improbable. In fact, the most attentive study of the disease in recent times favours the early notions as to its contagiousness.

Low and damp, as well as badly-ventilated stables have been accused of inducing the disease, and there can scarcely be a doubt that they at least predispose animals to it.

SYMPTOMS.

The disease, in almost every instance, commences very suddenly, and often without any premonitory symptoms ; except it be swelling of the submaxillary lymphatic glands, and a peculiar saffron-coloured tint of the visible mucous membrane, with sneezing. Many horses may be affected simultaneously, or within a very brief interval of each other ; so that within a few days, or even a few hours, all the horses in a large stable, in a locality, town, or city, or even a wide extent of country, may be suffering.

From the earliest period of the attack, there is extreme listlessness and prostration ; if in the stable, the sick animal stands almost immovable, the limbs are as if fixed to the ground, and it can only be displaced with difficulty. The eyelids almost cover the eyes, and appear to be swollen ; tears course down

the face; the head is carried low, and there are indications of severe headache, and more or less of stupor. In some cases the forehead is pushed forcibly against the wall; and in rare instances there are manifestations of frenzy. The animal is unable to work, from sheer debility and prostration; and if compelled to move at anything like an accelerated pace, will fall, and require assistance before it can get up again. There are periodical rigors, morning and evening, for several days, these being sometimes followed by profuse perspiration; there is also fever to a variable degree. The pulse is not much quickened, as a rule, though it sometimes reaches to sixty or seventy beats a minute, and is very weak and compressible; the heart's pulsations are very perceptible. The expired air is hot, and respiration is more hurried than in health, as well as shallow and difficult; but neither auscultation nor percussion reveal any marked alterations in the chest, with the exception of a somewhat sharp sibilant *râle* at the commencement. The animal generally manifests increased sensibility on pressure of the intercostal spaces; the throat is also more sensitive to pressure, which induces painful coughing; and the parotideal and submaxillary regions are tumefied. Usually there is a short, frequent, feeble, and painful cough, as if the animal were afraid to move the ribs: a circumstance which, as Zundel observes, has led some authorities to believe in the existence of pleural Rheumatism in this disease. The cough is dry, and in many cases spasmodic, causing much distress.

Frequently there is only loss of appetite, and the mouth is dry; sometimes there is sore throat to such an extent that when the animal drinks the fluid returns by the nostrils, and food is swallowed with the greatest difficulty. The fæces are rare and dry, and at times slightly covered with mucus, and fetid; the urine is also scanty and colourless, or yellower than in health.

The temperature of the limbs is variable; but that of the body is higher than in health, and particularly in the morning and evening. It varies from 100° to 106° or 107° in exceptional cases; it oscillates in a very irregular manner some-

times, and for as long as the malady lasts—often remaining higher than in health for a few days after recovery.

Towards the second or third day, in favourable cases, the appetite begins to return : though the animal does not attempt to lie down, but persistently remains standing, only resting a tired limb now and again ; the prostration is as marked ; there is a loud mucous *râle* in the air-passages, but the mouth is not so dry, and may even be filled with saliva. The cough is at this period soft ; a discharge from the nostrils, at first sero-mucous, then more consistent and flaky, commences, and is most abundant when the head is in a dependent position, or after coughing. The corner of the eyes is frequently muddy-looking, and there is inflammation of the conjunctival membrane, with muco-purulent effusion. The limbs are often œdematous, as well as the sheath and head.

According to the character of the epizoöty or individual predisposition, there predominate nervous, thoracic, or abdominal symptoms ; and various authorities have accordingly divided Influenza into several forms—such as the rheumatismal, gastro-rheumatismal, catarrho-rheumatismal, gastro-erysipelatous, abdominal, thoracic, &c., but careful observers, especially Falke of Jena, and Zundel of Mulhouse, have insisted upon the fact, that these various forms belong to typhoid diseases, which differ essentially from Influenza, not only in their symptoms, but in their course, duration, and termination. In Influenza, there is no absolute departure from the typical form.

COURSE AND TERMINATIONS.

When the malady is not complicated, it runs its course without any other marked symptoms, and its progress is regular, continuous, and rapid : the more urgent symptoms disappearing in about from seven to ten days, though convalescence is generally protracted. Signs of recovery are indicated by the animal appearing more lively, the head is carried higher, and the position is more frequently altered, while the pulse is less frequent, stronger, and fuller. In the majority of cases, the disease terminates by an increased flow of urine, which is sometimes thick, as if mixed with mucus and albumen,

or it may be slightly tinged with blood, and has a fetid odour ; in other cases, the crisis is marked by diarrhœa or profuse perspiration.

It is some time, however, before the strength is regained ; the cough persists for a somewhat long period, and the appetite is slow in returning ; indeed, the duration of convalescence is not at all in proportion to the length and intensity of the disease.

When uncomplicated, the malady is generally benignant ; and in Influenza proper, serious complications are unfrequent—a feature which distinguishes it from the so-called "typhoid" diseases. These complications are often observed in animals predisposed by some chronic affection. Pneumonia, and sometimes Pleurisy, are the usual complications, and the former assumes a special physiognomy. As Zundel has correctly stated, we seldom perceive the veritable fine dry crepitation of ordinary Pneumonia, but rather a "sub-crepitant" *râle* ; there are, in fact, symptoms of Bronchitis analogous to those of the capillary Bronchitis of the dog, and the dyspnœa is very intense and painful. The respiration is abdominal ; serous exudations readily and rapidly occur, but they are not of an ordinary character : the serum holding in solution a quantity of albuminous matter which coagulates on exposure to the air, and yields much fibrine, being, in all probability, the "fibrogene" of Virchow.

The liver and intestines are never seriously implicated, though they suffer sometimes through sympathy. The other complications are : cerebral or spinal Meningitis ; rheumatic Inflammation of the synovial sheaths ; Laminitis ; Œdema of the limbs, sometimes passing into that general form of œdema known as "purpura hæmorrhagica"—often a serious complication ; Hæmaturia, &c.

PATHOLOGICAL ANATOMY.

Death rarely occurs without serious complications ; so that we cannot readily arrive at the pathological alterations which occur in a simple case of Influenza. In those cases which have been examined, there has been found a passive congestion of

tissues or organs, but rarely inflammation. The mucous membrane of the nostrils, sinuses, larynx, and pharnyx, and sometimes as far as the bronchia, is red, injected and swollen, and the air-passages may contain a quantity of mucus. In particular cases, there is an apoplectic or hæmorrhagic congestion of this membrane in different parts. As Pneumonia is the most frequent and fatal concomitant of Influenza in nearly all the animals which die, we find the lesions of that condition. If Pleurisy has been present, there will be found exudations of a gelatinous serosity into the thoracic cavity, with the other morbid alterations which mark this inflammation. The other complications have, of course, their particular pathological lesions. In the blood micrococcus cells have been found, as well as in the urine and bile. These cells, when cultivated, become converted into cryptococcus cells, which again become *Sporangia*, and are finally developed into fungi not unlike the *Aspergillus glaucus*. The blood has also been observed to be darker-coloured in the arteries than in health, and to contain a large excess of fat and extractive matter. Large numbers of spores of various kinds have been found in the mucus discharged from the nostrils.

DIAGNOSIS.

The sudden prostration and apathy, and the torpidity and great distress which accompany Influenza; the fact of its affecting many animals at once; the presence of the symptoms just enumerated; and the appearance of the malady without any perceptible cause, should distinguish it from ordinary Coryza or Bronchitis. It is so different in its salient characteristics from Strangles, that a mistake is scarcely possible.

From the so-called "typhoid" diseases, it cannot be so readily distinguished; though it differs from them by its sudden invasion, and its arriving at its maximum of intensity in from a few hours to one or two days; while their premonitory symptoms sometimes last for eight days, according to Zundel. The symptoms of Influenza are also more simple, and have not that complex character and tendency to complications which mark these affections; and it runs its course more

rapidly, and usually terminates in recovery. The condition of the blood is also very different; for while in Influenza it is rich in fibrine, in the typhoid diseases, if this material is at all in excess at first, it quickly alters, and becomes soft and gelatinous; the red globules change their form, and become angular and irregular in outline; they also lose their colouring matter, which is diffused through the plasma; and at a more advanced stage bacteridia are present; in fact, the blood shows a tendency to Septicæmia, a condition but little different to that of Anthrax, and the opposite of inflammation and Influenza. According to the best authorities, the causes of typhoid diseases are more local, and are certainly chiefly miasmatic: such as feeding on altered forage, allowing horses to drink water contaminated by organic impurities, &c.

CONTAGIUM.

As has been already mentioned, the contagiousness of Influenza has been affirmed and denied for many years, and the most trustworthy observers are still undecided as to its transmissibility from diseased to healthy animals. The recent epizoöty in America would tend to prove that it is conveyed by sick animals, or those arriving from infected localities; and my own experience inclines me to look upon it as a communicable malady.

VITALITY OF THE VIRUS.

Of the nature of the virus and its vitality—if we are to consider this a virulent disease—we know nothing.

INFECTION.

The disease attacks all solipeds—horses, mules, and asses—and appears to affect the latter more severely than the others.

MODE OF INFECTION.

Infection almost invariably follows the introduction of sick animals, or those which have been in infected localities, among others which are healthy.

MODE OF ACCESS.

The infection doubtless obtains access through the respiratory organs.

INCUBATION.

This would appear to be brief, and probably limited to a few days.

EXTENSION.

The extension of the malady is generally too irregular and erratic to warrant the assertion that it is solely dependent upon atmospheric conditions for its diffusion. Of its origin, we have little but hypotheses to offer; after it has appeared, however, there can be no doubt that it chiefly, if not invariably, follows the lines of communication travelled by the equine species: those places which are not visited by animals from infected centres generally, if not always, escaping.* There is,

* The report of the New York Sanitary Committee notices this fact. It says, "Epizoötic Influenza does not spread solely by virtue of unrecognized atmospheric conditions. During the prevalence of the disease, the opinion was expressed by many thoughtful observers, that it was spreading through the air, or by virtue of some unknown atmospheric condition. In no other way did it seem possible to explain the sudden prostration of all, or nearly all, of the horses in a city or limited district. Subsequent investigation has not proved that the disease is *not* communicable through the air at short distances, and over limited areas. We have proved, however, that the spread of the disease over the country is not solely, or chiefly, by virtue of unrecognized atmospheric conditions. The irregularities in time and place in the appearance of this disease are so numerous and surprising, that they cannot be classified or brought into harmony with any system of laws that bears any resemblance to the laws which govern the phenomena of any of the recognized atmospherical conditions.

"Epizoötic Influenza spreads by virtue of its communicability . . . . no place was exempt from the disease which was known to have been in communication, by means of horses or mules, with places in which the disease existed. On the mainland of this continent, every place which is known to have had communication, by means of horses or mules, with places where the disease existed, suffered from the disease. In regard to the West India Islands, we have letters from two correspondents, which mention the importation of American horses into Havana. Cuba was over-

therefore, every reason to believe that the disease extends by reason of its communicability ; though within narrow limits it may infect through the medium of the atmosphere.

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run by the disease. . . . . The places that were exempt from the disease were so situated that the importation of horses or mules was in some of them impossible, and in others of them improbable. The following places were exempt :—Prince Edward Island, Vancouver's Island, Key West, the Island of Hayti and San Domingo, the Island of Jamaica, La Paz, and that portion of Mexico containing Minatitlan, Tabasco, and Madeira. Prince Edward Island and Vancouver's Island were sequestered, the former by the severity of a Canadian winter, and the latter by a quarantine against horses and mules. The islands of Key West, Hayti, San Domingo, and Jamaica, have a limited amount of commercial intercourse with the ports of this country or with Cuba, and the importation of horses or mules is probably a very rare occurrence. La Paz, near the extremity of the peninsula of Lower California, is so situated that, in all probability, there is no unbroken communication by horses and mules with those portions of Mexico in which the disease prevailed. The same statement can be made concerning Minatitlan, Tabasco, and Madeira, as the region in which they are situated is separated from the States of Vera Cruz and Mexico, in which the disease prevailed, by difficult and thinly-settled lowlands. . . . . The disease passed rapidly over those regions in which the towns and cities are numerous and in frequent communication with each other, and with comparative slowness over those regions in which the towns are less numerous and in less frequent communication with each other. . . . . The disease spread rapidly over the states east of the Mississippi and Missouri Rivers, where cities and towns are numerous, and where communication is rapid and easy ; and its progress was greatly reduced as it passed over the thinly-settled states and territories of the western half of the country, where communication is slow and difficult. There are many minor points which illustrate the fact that the rate of progress made by the disease depended on the amount and facility of commercial intercourse. Some of these points are, in brief, as follows :—The early appearance of the disease at New York, Philadelphia, Baltimore, and Washington, places situated on a crowded line of travel, and its late appearance in a large region lying between these cities and the starting-point of the disease, as well as in certain important cities and towns lying near, but not on, this great line of travel ; the rapid progress of the disease along the line of the Pacific Railway ; the arrest of the disease by the Sierra Nevada, impassable by horses and mules at that season, and its invasion of California, after flanking the mountains by way of the succession of the mining districts between Carson City and Inyo ; and the divi-

In some outbreaks it attacks in a very irregular manner—in some stables all the horses, without exception, will be affected; in others, only a few; while others will escape, though surrounded by the infection. Most frequently, one or two-thirds are attacked, those that are not involved appearing to be indisposed to receive the infection.

Its duration is also extremely variable. In some invasions, it will prevail for two or three months; in others for only two or three weeks; while on occasions it has continued for a year, and even longer. The American outbreak commenced in September, 1872, in Toronto, and had extended to British Columbia in July, and San Salvador in August, 1873; yet it only prevailed in New York for six weeks. In that city, on the evening of October 21st, 1872, only a few animals were affected, but next morning it was doubted whether every soliped was not attacked. Horses, mules, and even a zebra belonging to a menagerie, were affected almost simultaneously; more than 20,000 animals were suffering in different degrees.

MORTALITY AND LOSS.

Influenza is not a fatal disease, except to weakly animals, those suffering from some serious malady, when it is complicated with pulmonary affections, or when it assumes a plethoric or apoplectic character. Recovery is the ordinary termination, and this occurs often without any medical treatment, and simply by dieting and nursing. The mortality during an epizoöty varies, according to its dominant character. That reported by Naumann, in 1805, appears to have been the most benignant on record, as scarcely a death occurred. Spinola and Hertwig mention outbreaks in which the mor-

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sion of the current of the disease by the Sierra Nevada Mountains and the unoccupied territory in Northern California and Oregon, one division moving more rapidly than the other by reason of passing over a more thickly-settled region. The early appearance of the disease at New Orleans and Galveston, has caused the surmise that infected animals were landed at those ports by some of the numerous coasting steamers from New York and Philadelphia."

tality has only been ·50 to 1 per cent. of those attacked; and the first-named authority refers to others in which it was as high as 10 per cent.;* and Rey has witnessed, in an epizoöty at Lyons, one horse out of every three affected succumb. In 1872, in New York, where the disease was almost universal in its attack, and where it prevailed for six weeks, it was the first cause of death in 1412 cases, and the second cause in 534 cases; which gave 3·7 per cent. of the horses in that city destroyed by the epizoöty.

But if the disease is not of a very destructive character, it is the cause of much inconvenience, and, directly, of loss, by the sudden deprivation of the services of such an important animal as the horse, which may seriously interfere with business. The long convalescence which follows before those affected regain their strength, is another grave feature in the progress of such an universal malady.†

* When the mortality is described as very high, we may suspect the existence of typhoid disease or its complications, and not Influenza.

† This is strikingly illustrated in the American epizoöty. "Its appearance in a city was followed by the gradual withdrawal of horses and mules from the streets, until the busiest thoroughfares assumed the stillness of the Sabbath. Serious inconvenience to all classes of the community was thus occasioned. Dealers in provisions were unable to supply all their customers. Business men found it difficult to reach their offices by reason of the withdrawal of stages and horse-cars. Those branches of industry that depend essentially on the use of horses or mules were entirely arrested. In San Francisco, it was stated that the disabling of 3000 horses had thrown out of employment from 5000 to 10,000 men. In San Francisco, as well as in many eastern and southern cities, oxen were introduced from the country, and were used in the transportation of goods. Large quantities of goods accumulated in factories, freight-depots, and warehouses. As the disease spread gradually through the southern and western states, it showed the same symptoms; caused, so far as can be ascertained, the same mortality; and produced the same derangement in business. At Cairo (Illinois) and Savannah (Georgia), the price of drayage was doubled. Farmers had difficulty in getting their produce to market, and the carriage of the cotton crop was retarded. Having traversed the eastern half of the breadth of the continent by the middle of December, the disease invaded successively the states and territories of the Far West. The people of this region were greatly embarrassed by the effects of this epizoöty. Relying exclusively on transportation by horses and mules, many settlements and military posts were, for a time, entirely

IMMUNITY.

One attack does not afford permanent immunity from another; consequently, a horse may have several attacks during its life.

SANITARY MEASURES.

PREVENTION.

We know of no means of preventing an outbreak of Influenza, as we do not know the causes upon which its origin depends. When the disease exists in a neighbouring country, its invasion might be prevented by prohibiting the entrance of solipeds therefrom; but in many instances this must be difficult, if not almost impossible, particularly on large continents. Islands offer greater facilities for this prohibition, as well as for the imposition of quarantine on all equine arrivals.

Though good hygiène and careful management will do much towards shortening the duration of an attack, and rendering it less severe, yet they will not insure animals so treated against its invasion.

SUPPRESSION.

Isolating the sick, preventing all direct or indirect contact between them and healthy animals, and scrupulous cleanliness and disinfection, are the suppressive measures to be observed.

CURATIVE MEASURES.

In the benignant, uncomplicated form of Influenza, little more is required than rest; comfortable stabling, with good ventilation; keeping the body warm by clothing, if the stable is cool; giving light, sloppy mashes, and plenty of tepid oatmeal gruel, to which nitrate of potash, or the carbonate or

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deprived of even mail communication." At the Lava Beds, California, it was reported that the cavalry operating against the Modoc Indians were dismounted, through their horses being all attacked by the Influenza.

sulphate of soda has been added. Green forage is to be recommended. Depletive measures must on no account be resorted to, as debility is always a marked feature of the disease. When the debility and prostration are very great, tonics and diffusible stimulants, in small but frequent doses, are necessary. Camphor is very serviceable. If the malady assumes a more inflammatory or sthenic character, with a tendency to lung or pleural complications, small and often-repeated doses of tincture of aconite are very useful, with mustard cataplasms to the sides of the chest. Cough will be relieved by the application of stimulating liniment to the upper part of the throat, and the inhalation of hot water vapour. This treatment, with enemas, friction to the limbs, maintaining the warmth of these by woollen bandages, and attentive nursing, generally bring about a speedy recovery.

Much care is required during convalescence; moderate exercise only must be allowed, and good, easily-digested food given. Tonics will shorten this stage.

Complications must be treated according to their indications.

VARIOLA.

ALL the domesticated animals have their peculiar form of Variola or Small-pox, but some species are more severely affected than others; and the contagion being, in one species at least, very virulent, sanitary measures must be resorted to in order to prevent its extension, and the loss consequent upon its invasion. We will describe the Variola of each species separately, and now only notice the general character and nature of the disease.

CHARACTER.

Variola is an acute febrile disease, which may be developed in all the domesticated animals; it follows a regular course, and is characterized by the appearance of a vesicular or pustular eruption on the skin.

NATURE.

This disease belongs to the zymotic class, and is propagated solely by contagion: its spontaneous development not being satisfactorily demonstrated. In its general features, it bears a close resemblance to the other contagious diseases. After the reception of the contagium, there is the usual incubatory period, at the termination of which a febrile condition ensues, and the characteristic exanthema is manifested. This eruption consists in a series of alterations that occur in a regular manner, and which are most easily studied on a white-skinned animal. At first, there appear in certain parts of the integument small reddish nodules, surrounded by a red-coloured areola; these gradually increase in number, and in a few days are transformed into areolar vesicles containing a transparent lymph.

Many of these vesicles are depressed or umbilicated towards their centre, and in a short time their contents becomes purulent. The vesicles having now become pustules, lose their peculiar umbilicated appearance as soon as their envelope is completely distended. The purulent contents dries, and there is formed, instead of the vesicle, a dark brownish-coloured crust, which is finally detached from the epidermis that has been more or less reproduced in the interval of drying, leaving a cicatrix of variable dimensions. If the vesicles and pustules are numerous and close, the skin between them is tumefied; and in these serious cases, a similar eruption is developed on the mucous membranes.

The fever is generally most intense before the exanthema appears, but subsides soon after; though only to become higher as the suppurative process advances. When desiccation begins it disappears. In unfavourable cases, and particularly when symptoms of pyæmia show themselves, the febrile phenomena usually become very marked.*

THE VARIOLA OF SHEEP.

SYNONYMS.—Technical: *Variola ovina, Variolæ ovillæ.* English: *Sheep-pox.* French: *Clavelle, Clavelée, Claveau, Clavin, Glavelle, Picotte, Picotin, Verrelle, Verolin, Rougeole, Boussade, Gamage,* &c. German: *Schafpocken, Schafblattern.* Italian: *Vaiuolo pecora, Vajuolo pecorino, Schiavina.* Spanish: *Morrina.*

GEOGRAPHICAL DISTRIBUTION.

The Variola of sheep is a very common disease in some parts of Europe, while in others it is rare or altogether unknown. In Hungary, Austria, and different parts of Germany it is often observed, and appears to be almost enzoötic in some districts; in France, it is also a well-known disease among the flocks, and in Berry, Sologne, Brie, Champagne, and Auvergne it is so prevalent, and serious outbreaks occur at such short intervals, that some authorities have asserted that it reigns permanently there. Indeed, so universal does

* The structure of, and changes occurring in, the variolic pustules are well described in Röll's *Manual of Pathology.*

it seem to have prevailed in France in the time of Bourgelat (the founder of the French veterinary schools, and the father of modern veterinary science), that he declared that no sheep attained its maximum duration of existence without suffering from it.

Before the very contagious character of the disease was known, it was widely spread on the continent of Europe, and the destruction it caused was very great: the flocks of entire districts being nearly decimated, and the contagion becoming enzoötic in many districts and countries. In France, for instance, it has been calculated that, in 1819, more than a million of sheep perished from Variola; and Laubender has estimated the annual loss in Prussia and Austria, about the same period, at a similar figure. With the progress of veterinary science, however, the ravages of the malady have been diminished, and the contagion is more limited in its extent; indeed, it is in many places entirely eradicated, only appearing with the importation of sheep from infected regions. Such has been the case in the South of France, into which German or Algerian sheep are introduced. In Saxony, Bavaria, Wurtemberg, the Duchy of Baden, and Alsace, the disease is only observed during or after the passage of flocks from Hungary to the Paris fairs. It is the same in the North of France. In the Prussian provinces, particularly those on the Baltic, the disease prevails permanently, through the mistaken practice of inoculating healthy sheep as a preservative measure. This is also the case in the Scandinavian provinces, in Poland, in a portion of Russia, in the Danubian Principalities, and particularly in Hungary. Eastern Germany frequently receives the malady from this quarter. It has been known in England from the very earliest times, and several serious outbreaks are on record;* indeed, the disease is first mentioned for certain in ancient Anglo-Saxon manuscripts.

* For an historical account of this malady in England, in early times, see *Animal Plagues*, pp. 79, 188. In addition to the notices given in that work with regard to England, *add* Mascall's description of the disease, the symptoms of which are fairly enumerated, its contagiousness being particularly noticed. His curious treatise on the diseases of cattle, sheep, and dogs, was published in London in 1596.

It prevails as an epizoöty in Algeria, whence it is frequently imported into France. It is unknown in America,* Australia, New Zealand, and South Africa. In 1869-70, more than 16,000 sheep were affected with the disease in Thessaly.

NATURE.

This is an eruptive contagious disease peculiar to sheep, often extremely fatal, only attacking an animal once, and appearing as a contagious epizoötic or enzoötic disease. It usually prevails as an epizoötic disease, extending rapidly, owing to its highly contagious properties.

CAUSES.

The most diverse opinions have been from time to time emitted with regard to the origin of this disease, but none are worthy of notice, and all observation hitherto proves that its development and diffusion depend upon its contagious principle. It most frequently appears as an epizoöty on a great or small scale, and like the Variola of mankind, has its periods of recrudescence in those countries which are most harassed by it. In some years its attacks are comparatively mild, and it may only affect a portion of a flock; in other years it reigns widely and spares but few, and the rate of mortality is high. We know not to what this variability is due, and we can only recognize the all-important fact, that the maintenance and extension of Sheep-pox is due to its contagiousness, however much this may be influenced by external circumstances.

SYMPTOMS.

The disease is by some authorities divided into "benignant" and "malignant;" by others, into "discrete" and "confluent;" and by some, again, into "regular" and "irregular" Variola. The symptoms are sometimes divided into three groups: those manifested at the commencement or

* It must be noted, however, that a disease named "Sarna" attacks the flocks of Alpacas, in Peru; it has been described as a pustular and highly contagious malady, and very destructive. This may be a kind of Variola.

invasion of the malady, those of suppuration, and those which are coincident with desiccation or desquamation.

The earliest symptoms are slight dulness and diminution of appetite; with perceptible rigidity, and pain on pressure, of the back and hinder extremities; these are soon succeeded by indications of fever, trembling and shiverings, with elevation of temperature, which by the hand will be most noticeable at the ears and nose. But before the rigors have manifested themselves, the thermometer indicates an elevation of internal temperature. In thirty-six to forty-eight hours it increases 1·5° to 2°; and on the second day it is generally 105·8° to 107·6° or 108°. In regular Variola the temperature decreases at the commencement of the eruption, and often falls to nearly its normal standard in twenty-four hours. In confluent Variola it is slower and later in diminishing, and more irregular; it ascends again at the commencement of suppuration, becoming normal at the end of this period and the commencement of desiccation.

The pulse is quickened to eighty or ninety beats per minute, much dulness is manifested; the head is carried low, and the ears are pendent, with all the limbs gathered under the body; the fæces are in small, hard, dry pellets; the conjunctival membrane is highly injected, and the tears are increased; while a thin discharge, which gradually becomes thicker and viscid, escapes from the nostrils, and the cutaneous emanations and breath have a characteristic sickly, honey-like odour. The internal temperature, still ascending, announces the eruptive period: the eruption, however, not being always in proportion to the intensity of the fever; for in irritable, well-fed sheep, the latter may run high, and the exanthema be only moderately developed. Most frequently, towards the second or third day after the appearance of the fever, there are seen on those parts of the body where the skin is finest, and which are least concealed by wool (though it is not absent where the wool is thick), as on the head (particularly around the eyes, nostrils, and mouth), on the inner aspect of the thighs, the chest, and belly, udder, and lower surface of the tail, little, red, circular spots, not unlike flea-bites; very

soon (perhaps in a day), these spots have become nodosities or pimples, lenticular in shape, and purple in colour, with a well-defined margin, and slightly flattened in the centre ; these gradually increase in size. Towards the fourth or fifth day of the eruption (eighth to the twelfth of the disease), the nodosity becomes pale and elevated in the centre, and somewhat transparent, owing to the epidermis being raised by a small quantity of serous fluid, which is extremely virulent. The exanthema has now assumed the vesicular form, and each vesicle is surrounded by a prominent, hard, and red-coloured areola, which pertains to the derma.

The eruption does not appear on every part of the body at once ; consequently it is not developed to the same degree in the different regions. During its existence the skin is greatly congested, particularly where the vesicles are most numerous; there it appears to be considerably inflamed, and the tumefaction is sometimes so exaggerated that the lips and wings of the nostrils are quite deformed.

When the exanthema has assumed the vesicular form, the fever diminishes, or even disappears. Towards the sixth day the vesicles are occasionally umbilicated, and contain a viscid, glutinous fluid, which only partly escapes when they are punctured, because of their multilocular structure. This is the "suppurative" or "pustular" stage ; and the vesicles having become pustules, are now said to be mature, their contents being transformed into pus. Each pustule increases in size, and becomes yellower in colour ; while its areola extends, and frequently joins the adjacent areolæ. Should the fever have disappeared, it frequently shows itself again at this time, or it becomes aggravated if it still exists ; the swelling of the eyelids, lips, and nostrils is greater, and the discharge from the nose and mouth continues. The pustule exists for about three days ; though, as the eruption does not take place at once, the pustular stage may last for five or six days.

After this comes the "desiccative" or "desquamative" stage, when the aqueous portion of the pus disappears, and its solid particles condense : at first in the middle of the pustule, in the form of a yellowish crust, which changes to a gray, and

then to a dark-brown colour, as it extends to the circumference. Closely adherent at the commencement, this crust is detached in five or six days, leaving a wine-coloured stain; or less frequently, a red, hairless, slightly hollow cicatrix, on which the wool grows at a late period, though not so abundantly as before.

When this desquamative stage begins, the febrile symptoms and catarrhal phenomena vanish; the appetite and rumination return, and convalescence is rapid in proportion to the mildness of the fever.

During the course of the disease, though in rare cases, there appears a secondary eruption of undeveloped pustules, which disappear by resolution before or during the maturation stage.

With regard to internal temperature in ovine Variola, it has been remarked that this is variable. The average of cases shows it to be most elevated at the commencement of the disease, and moderate during the eruptive stage; rising again when the contents of the pustules become purulent. It is lowest in those cases in which the pustules have attained their greatest development, and which, when they are incised, yield much translucid serosity and little blood. The temperature falls considerably when death is about to occur.

COURSE AND TERMINATIONS.

The course of the disease is not always marked by the regular or methodic evolution of the symptoms enumerated in the preceding description, which applies more especially to the benignant form of the disease; neither is the issue generally so favourable. Indeed, of all the diseases to which sheep are liable, this is the most contagious, and perhaps the most fatal, as well as the most irregular in its symptoms.

The latter deviations are chiefly related to the degree of fever, the intensity of the eruptive process, and the incomplete development or small number of the pustules. This irregular course has been divided into two forms—"asthenic" and "hypersthenic" Variola; or into "confluent," "discrete," and "hæmorrhagic" or "malignant."

In the asthenic form, the development of the eruption takes

place slowly, and the nodules are grayish-red in colour, and agglomerated; instead of reaching the suppurative stage, however, they subside, or blacken and dry up. The cellular tissue is infiltrated; the head, ears, eyelids, nostrils, and lips are tumefied; the eyes are dull and obscured by muco-purulent matter, and the corneæ become ulcerated; a thick blood-tinged pus flows from the nose, and the lining membrane is swollen, livid, ulcerated, and covered with crusts. The respiration is sniffling; a viscid and fœtid foam fills the mouth, which is also ulcerated, and mastication is difficult or impossible. Great debility is present; the animals continually lie, or drag themselves about with difficulty; the wool falls off; respiration is oppressed; emaciation, sometimes accelerated by a fœtid diarrhœa, ensues, and the creatures succumb. This form is most frequently witnessed in cold and damp seasons.

The "hypersthenic" or "malignant" form, is marked by the impetuousness of the eruption; within two days the body is covered by bosselated tumours filled with sanious pus, resulting from the agglomeration of the nodules; their colour is livid, and gangrene quickly sets in, involving the parts on which they are located: the ears, tail, udder, eyelids, and even the eyes, sloughing away partially or entirely. A violent fever precedes and accompanies the eruption, and a very fœtid odour is given off from the body. Pustules often appear on the mucous membrane of the mouth, pharynx, nose, and elsewhere; and the skin in the vicinity of the agglomerated nodules or pustules is discoloured by petechiæ. As soon as gangrene sets in, prostration is great, and death, which is nearly always the termination of this form, soon ensues, especially if the pustules (or pseudo-carbuncles, as they might be termed) become emphysematous. The animals which recover are usually deformed and crippled, or so much injured as to be almost worthless.

When the pustules are about to appear in abundance, there is seen, at the very commencement of the disease, the red spots already indicated as appearing some time after the first symptoms; these are soon replaced by an erysipelatous redness and tumefaction of the skin, and the nodules which

form are collected in clusters, so that the vesicles and pustules run into each other. This is the "confluent" type of the disease. The papillæ of the derma inflame and suppurate, and abscesses form in the subcutaneous conjunctival tissue; these sometimes extend in depth, and may produce mortification of patches of skin, the ears, lips, eyes, and even the joints. The fever is very intense, and does not disappear until after the vesicles have become developed, and increases during the suppurative stage. The signs of Catarrh of the respiratory, buccal, and pharyngeal mucous membrane are very marked; from the nose flows a thick, viscid mucus which obstructs the passages and renders the breathing difficult, and a slimy saliva dribbles from the mouth. Not unusually a pustular eruption manifests itself on the mucous membrane of the pharynx, the trachea, and bronchia; and at times the lymphatic glands in different parts of the body become tumefied, inflamed, and suppurating, leading to much emaciation. The cutaneous tumefaction begins to diminish when the pus dries, and is transformed into thick brown crusts. The shedding of the latter is often followed by slow healing ulcerations, which, when cured, leave behind them irregular shaped cicatrises.

Most frequently the animals perish either during the acute period, or later. In the first instance, symptoms of pyæmia precede death; in the second, a fatal termination is brought about by the prolonged suppuration, which produces exhaustion.

Frequently in the same animal, beside and between the perfectly developed pustules, are observed others which are red, elongated, and only contain a minimum quality of fluid; these are most numerous on the abdomen and about the perineum, and are designated "flat variolæ." Their maturation and desiccation is usually more protracted than in the ordinary pustules; they are oftenest seen in weak animals, and during damp cold weather, and in this respect resemble those of the asthenic form of the disease.

Another variety is named the "papular," and also pertains to the asthenic type. The nodules are hard, gray, brick-red, or reddish-brown, and appear on an infiltrated portion of the

skin ; they are not surrounded by an areola. The epidermis gradually desquamates without suppuration intervening, and the eruption at last disappears. Notwithstanding the absence of vesiculation and suppuration, this papular Variola is as contagious as any other form.

In "discrete" Variola, the pustules are few, often only from three to eight or ten on the face, the inner surface of the thighs, or the belly ; and there is but little, if any, fever.

It will be seen from the above remarks, that the course and termination of this disease will vary according to the type it assumes, and the extent of the local disturbance, the intensity of the general symptoms, and the external conditions to which the sheep are exposed. In general terms, it may be pronounced a dangerous disease. Its course is most favourable in acclimatized or indigenous flocks which are in robust health and good condition. Its course may also be said to be favourable when the eruption is limited or discrete, the general disturbance not intense, and if the malady prevails in clear, dry, and temperate weather ; and more especially if the animals are properly dieted, and kept in large, well-aired, and clean dwellings.

The course of the disease is unfavourable if it attacks old, debilitated, or sickly animals; if it occurs during cold, foggy, or damp and hot weather, or during the prevalence of cold winds and rain ;* also if sanitary or hygiènic conditions are at fault. It is also most serious if the pustules are very numerous and close, and confluent or gangrenous. Among animals closely packed, the disease appears nearly always in an aggravated form. Young sheep, especially lambs, suffer most, and are least likely to survive ; and with regard to sex, it has been

* The peculiar influence of temperature on the course of the disease has often been made the subject of comment. The eruption which appears during dry and warm weather, almost entirely disappears after a sudden change of temperature, or the advent of cold and damp or rain. Girard, the elder, mentions the case of a flock of a hundred sheep, in which a change of temperature in the month of June caused the variolous pustules which were fully or in course of being developed, to disappear ; about the fifteenth day the fine weather returned, and a new eruption showed itself, which was not completed until the twentieth day.

noted that males are more seriously affected than females. The ewes frequently abort and die ; and in the fœtus, as well as the new-born lamb, the characteristic lesions of the disease are not unfrequently present. When abortion does not occur, Hertwig has observed that the offspring is afterwards refractory to the action of the virus. The same authority has remarked, however, that the inoculated disease does not appear to be so readily communicated to the fœtus as that acquired in a natural manner. Gestation, dentition, and old age are all unfavourable conditions.

Death is the consequence of a septic state of the blood, general anæmia, pyæmia, or other complications : such as inflammations, croupal or diptheritic exudations, gangrenous destruction of the nasal, buccal, or pharyngeal mucous membrane, Pneumonia, Œdema, hyperæmia and follicular inflammations of the small and large intestine, Arthritis, inflammation and suppuration of the periosteum, subcutaneous abscesses, diffuse suppuration of the conjunctival tissue, inflammatory and suppurative processes in the lymphatic glands, &c. Or the nervous system may be affected, and different manifestations of this occurrence may be the result, such as convulsions and paralysis.

The duration of the disease in a sheep, when regular in its course, is from eighteen to thirty days, depending upon external temperature and other circumstances. The shortest period is eight to ten days.

PATHOLOGICAL ANATOMY.

The alterations, of course, vary with the type of the malady and its complications. The external lesions have been already described ; the internal differ in different cases. The brain and spinal cord, lungs, digestive organs, air-passages, lymphatic glands, liver and spleen, and serous membranes of the thorax and abdomen, may be the seat of congestion, inflammation, exudation, purulent deposit, softening, &c.

Many of the lesions disappear when the animals have been killed by the effusion of blood during the course of the disease;

so that when prepared in the usual way by the butcher, there may only remain one sign by which animals that have been affected by the malady may be recognized: the congestion of those lymphatic glands that have escaped his knife.

DIAGNOSIS.

This malady can scarcely be mistaken for any other affecting the ovine species. The so-called "chicken-pox" of sheep *(Varicella)* is so different in every respect, that it cannot be confounded with the eruption of Variola. The eruption consists of little red nodules which, in from twelve to twenty-four hours, are conical pustules, and the disease runs its course in from four to six days.

CONTAGIUM.

The contagium is "volatile" and "fixed," and exists in the blood, excretions, secretions, cutaneous emanations, expired air, and generally throughout the body. It must be noted, however, that some doubts have been entertained as to the existence of the virus in several of the excretions and secretions; and Chauveau has shown that when the respiratory passages are not involved in the eruption, the nasal mucus of a diseased sheep is not virulent. The virus exists in its most concentrated form in the solid portion of the lymph or pus which appears in the pustules, and in the crusts which remain after these have become desiccated.

Brought into contact with an absorbing surface, administered internally, or given in the food or water, the contents of the vesicles or pustules will produce the disease in healthy animals. The immediate contact of a diseased sheep, or its cohabitation with a flock, will certainly lead to the development of the malady among the individuals composing it. Foreign bodies of all kinds: the walls, mangers, woodwork, floors, &c., of dwellings occupied by the diseased; forage, litter, wool, skins, alimentary matters impregnated with or covered by the pustular matter, or the discharges from the mouth, nose, or eyes, are also very active media in transmitting the contagion.

Chauveau asserts that the period when the risk of contagion is greatest, is when the matter of the pulmonary nodosities is carried off by the nasal discharge and the expired air, and infects everything around the diseased animal. Always extremely rich in active corpuscles, like the variolous matter in general, that which is expectorated may, in falling into the water drunk by healthy sheep, or upon forage, infect these through the digestive organs; or after being deposited and dried upon any object, it may become detached, through rubbing, as a fine powder held in suspension by the air, and in this way be received into the lungs of healthy animals. The expired air may carry the virulent corpuscles directly from the affected air-passages, and disperse them abroad in the atmosphere.

In this volatile condition, the air may transport the contagium to considerable distances, and thus be the means of infecting flocks which are beyond the reach of immediate contact. Around the diseased animals, in the places which they inhabit or frequent, the emanations given off from the pustules, the skin, by the breath from the lungs, the discharges from the eyes, nose, and mouth, &c., form a contagious atmosphere so potent, that healthy animals exposed to it for only a short time are certain to contract the malady. In this way men, animals (including birds and insects, such as flies), inanimate objects, clothing, forage, litter, &c., which have been in this saturated atmosphere, become impregnated with the virus, and are capable of transporting it to great distances. The contagium has been carried by the air to a distance of twenty-five to thirty mètres (eighty-two to ninety-eight and a-half feet); which distance has been increased to 200 mètres (219 feet), and even 1000 feet during windy weather.

The exact period at which the virulent principle is present in the sick animal, has not yet been satisfactorily ascertained; but it is probable that it is being elaborated during the incubatory interval, is present at the commencement of the eruptive stage, and attains its maximum of intensity when the pustules have maturated. It possibly remains until the crusts have been shed, and the animal has quite recovered. The

disease may be conveyed during the convalescent stage, and even some time after.

The contagium of Sheep-pox is very active. The observations and calculations of Chauveau, with regard to the infectiousness of the malady compared with that of Vaccinia, tend to prove that animals attacked with the first-named disease will infect a hundred times more readily than those suffering from the latter. The variolous matter, according to the same authority, contains, in an equal volume and weight, a much more considerable number of virulent corpuscles, and is much more active, than that of Vaccinia. He has shown that if the latter is diluted with fifty times its quantity of water, inoculation with it is very uncertain; while the variolous humour may be diluted with 1500 times its volume of water before it reaches the same condition. He has also demonstrated that the activity of this matter, like every other virulent substance, resides in the solid granules or elementary corpuscles held in suspension in the serum, which is not virulent; and that an equal quantity of variolous fluid contains thirty times more of these particles than that of Vaccinia.

Hallier and Zurn have discovered in this matter, and especially in the pustules, a great quantity of vibriones which move actively about, as well as filaments and ciliated cells with a small nucleus.

VITALITY OF THE VIRUS.

The tenacity or vitality of the virus is influenced by several conditions, according to which it may retain its virulency for a longer or shorter period—from only one day to six months, or even a year. When protected from the action of the air and other destructive agencies, it preserves its properties for a considerable time. It has frequently been observed that sheep placed in a pasture which has just been vacated by diseased ones, become affected, even if they only remain for a short time in it; and some high authorities state that the contagion may maintain its activity for some days. But there can be no doubt that exposure to sunlight, rain, or heavy dew, will destroy or attenuate its virulency; for it is not rare

to see sheep frequent infected pastures after rain or the morning dew, without sustaining any injury. In confined and badly ventilated places, it is different ; and the infection has been retained in them for five months, and even a year. Hurtrel d'Arboval gives an instance in which a flock that had recovered from the disease for a year, contaminated another healthy flock ; other instances are given of contamination after three and six months. Inoculated sheep have infected others two months after the symptoms have disappeared. The disease has also been conveyed by a shepherd, whose sheep, two months previously, had suffered from Variola, to the inhabitants of a sheep-fold five leagues distant.

The skins removed from diseased sheep, and which had been dried for eight days, when placed among a flock did no harm. Fragments of these skins, strewn over the litter, were also innocuous.

A high temperature, chlorine, alcohol, and all powerful disinfectants, will destroy the activity of the virus. A heat of 50° Centigrade (122° Fahr.) will destroy its virulency ; as will frost, and even those disinfecting agents, as ozone and permanganate of potash, which do not neutralize the potency of Glander, Cattle-plague, or Anthrax virus. Putrefaction, and even suppuration, annuls its activity ; according to Haubner, the matter from suppurating wounds will not infect, and D'Arboval states that it has already lost its potency when the serosity of the pustule becomes much troubled.

INFECTION.

The Variola of sheep is not transmissible to other species, according to some authorities ; while others state that inoculation with the lymph protects mankind from Small-pox, in the same way as vaccination. With regard to the latter statement, it must be remarked that the evidence is not conclusive ; it appears, however, to be finally established that the human Variola will not produce that of the sheep, nor that of the sheep the Small-pox of man. Several instances are on record, nevertheless, which prove that veterinary surgeons who have been accidentally inoculated with the virus have suffered

from local and general disturbance, like that produced by vaccination.* Roll has unsuccessfully attempted to inoculate cattle with the Variola of sheep, and *vice versâ;* but Zundel has given an instance in which two cattle were directly infected, through cohabitation with diseased sheep.†

Haubner mentions that inoculation with the ovine variolous matter has sometimes produced pustules on the dog and pig; but the matter from these did not reproduce the malady in the sheep. Hertwig and Hering assert that the malady is readily communicated to goats in a true form, and may be transmitted from them to the sheep. In the goat, the pustules are usually smaller, and the general disturbance is less marked. The infection is not very certain, as goats frequently associate with diseased sheep without becoming affected. Hering has seen fifty-four goats so placed, and only ten became sick. According to Kersten and Gerlach, reciprocal inoculation of goats and sheep is always successful; and according to the observations and experiments of Gasparin, Dominick, Curds, and Spinola, and still more recently of Gerlach, there appears to be a close identity between the Variola of hares and rabbits and that of sheep, and inoculations from one species to the other have always yielded positive results.

The virus in either its volatile or fixed form will produce the malady; and age, sex, or condition do not afford any certain immunity, however much they may influence the course of the affection.

MODE OF INFECTION.

The manner in which the transmission of the virus from diseased to healthy animals may be effected, depends upon circumstances. Sometimes the infection is received directly from the sick or convalescent animals which find their way among healthy flocks; or it may be obtained from the roads, pastures, folds, or other places which are or have been fre-

* See Medizin. Jahrbuch des Œsterreich Staates: Mittheilungen aus der Thierärztlichen Praxis in Preussen. Jahrgang 17. Magazin für die gesammte Thierheilkunde, 1873, p. 467.

† *Journal de Méd. Vétérinaire de Lyon*, 1867, p. 185.

quented by variolous sheep; or it may also be derived from various matters, objects, or animals, such as the fresh skins and wool procured from the diseased, manure, fodder, the clothes of attendants on the sick, dogs, cats, rabbits, hares, birds, &c. The atmosphere may also convey it for a certain distance. Railway-waggons and ships employed to carry sheep, will also prove as efficacious in transmitting the infection, should they have become contaminated, as sheep-folds or pastures.

MODE OF ACCESS.

The ordinary channel by which the contagium enters the body is the air-passages, through the medium of the inspired air; but it may also obtain access through the skin and the more superficial mucous membranes: such as those of the eyes, mouth, and nostrils.

All these surfaces are not equally favourable to the penetration of the virus, however. The skin, although most exposed, is less apt to admit it than the mucous membranes; and though infection may follow the application of the virus to a thin, fine portion of this integument, yet in nearly every case, to be successful, the matter must be repeatedly applied in large quantity, and a certain amount of irritation must be produced. The digestive mucous membrane stands next in order, but the most accessible of all channels is that of the respiratory membrane. The virus, when dried and in the form of powder, and inhaled by sheep, is almost certain to produce the disease.

Towards the middle of the last and commencement of the present century, it was known that the malady could be induced by causing animals to swallow the contents of the pustules, or the crusts; and this method was resorted to for getting sheep through the disease, instead of by inoculation. That the virus can be introduced by the digestive apparatus, has been experimentally proved by Chauveau. Sheep were infected through being made to swallow only ten centigrammes of variolous matter, diluted in water, and given at twice in small quantities, before and after food. It was afterwards

ascertained that there was no abrasion of the lining membrane which might have led to inoculation.

The virus may also be intentionally introduced beneath the skin or mucous membrane, and the disease be thus induced artificially. This inoculation is frequently practised.

INCUBATION.

The interval which elapses between the reception of the contagium and the appearance of the earliest symptoms, is somewhat variable in this disease. In natural infection, it is given as from six to eight days in warm weather, and longer in cold or damp. D'Arboval states it be from ten to twelve days in summer, from twelve to fifteen in mild weather, and from twenty to twenty-four in winter. Within two or three days, more or less, this is the interval given by the best authorities.

In inoculated animals the period is generally shorter, being from three to six days in summer, and ten or twelve days in winter. Exceptional cases are on record in which this interval has been prolonged: in one instance, in which inoculation was practised during a severe winter on an animal kept in a very cold shed, the eruption did not appear for ten weeks; other instances are noted in which it was a month and two months.

In general terms, it may be said that the duration of the incubatory period is subordinate to the activity of the virus, the aptitude of the animals, the external temperature, and also, perhaps, to what has been designated the "epizoötic influence" of the year or season.

EXTENSION.

The extension of the Sheep-pox depends upon its infectiousness; as it is, according to the best observers, a purely contagious or infectious disease. It may therefore be propagated in various ways, like the Cattle-plague and other virulent maladies. The contagium is usually disseminated by cohabitation of the sick or convalescent with the healthy; by the latter being situated in the vicinity of the former,

though without coming actually into contact with them; by the proximity of a contaminated sheep-fold, pasture, or park containing diseased sheep; by the sojourn of healthy animals in these places; by the passage of a healthy flock on the track of a diseased one, or along roads by which the latter has travelled; by butchers, sheep-dealers, shepherds, and others, who go among healthy sheep after visiting and handling those affected with Small-pox; by the wool, skins, and manure derived from these, as well as all the objects which have been near or in contact with them; and by various animals.

The disease most frequently appears in an epizoötic form, and generally on an extensive scale, every five, ten, or fifteen years in some part of Europe; though minor outbreaks are much more frequent.

When it appears in a flock, it does not simultaneously affect all the individuals composing it, but rather attacks them by divisions. For example, a few sheep at first sicken, and the disease is slight and circumscribed: this period may last for a month; then a second and a larger number are seized, perhaps the majority of the flock, and the symptoms are more intense: this invasion continues for thirty to forty days. Finally, towards the third month, the remaining portion of the flock, which had hitherto resisted the contagion, is affected as was the first instalment; the disease being much less severe than it was with the second division. These starts prolong the duration of the disease in a flock to three, four, and even six or seven months; they have been attributed to the disease not being equally contagious at its different periods, and, consequently, the animals not all having the same constitutions, have not the same aptitude to contract it.

It does not always appear with the same virulency or capacity for extension: sometimes limiting itself to a flock or a district, and exempting many individuals from its attack. It is generally less disposed to extend as the infection centres are less concentrated or crowded, and the animals are more dispersed. Its spread is not so rapid from place to place in winter: a circumstance due, in all probability, to the fact that

the contagium has not the facilities for transmission it possesses at other times, and also that the cold diminishes its activity. In the spring, when the animals are turned out to pasture again, it widens its boundaries, and increases in intensity.

In England, it is now only known as an imported disease. The terrible outbreak in A.D. 1276, and which lasted twenty-eight years, was due to importation from France; so was that of 1847 and 1862 due to foreign sheep.

MORTALITY AND LOSS.

The mortality varies according to the severity of the epizoöty, the constitution of the animals, the hygiènic conditions in which they are maintained, as well as the season of the year and its regularity, &c. It is generally least in temperate or cool weather. When newly imported into a country it is, as a rule, very fatal. Under any circumstances, when developed in a natural manner it is always a most serious disease. Even in benignant outbreaks, the deaths are seldom below ten to twenty per cent. And at certain periods, when it appears as a widely extended epizoöty, it carries off one-half, two-thirds, or even more of the flocks attacked by it; in some instances all perish.

In France, the mean mortality among the affected flocks is twenty, the minimum fifteen, and the maximum thirty to forty per cent. In Prussia it is less, while in England it was about fifty per cent. Perhaps it is not far from the truth to assert that, among flocks in countries where the disease is not a novelty, the mortality is from twenty to twenty-five per cent., the minimum being ten to fifteen, and the maximum thirty to forty.

As has been said, the mortality differs in different invasions, and even in different regions during the same invasion. Among animals inhabiting a country in which the disease frequently appears, and which are indigenous, the faculty of resisting the malady is greater than among flocks which are crossed, highly bred, and among which Variola is seldom, if ever, seen. With the hardy indigenous flocks, the mortality

may fall as low as five or six per cent., as with the ancient hardy breeds of Sologne and Berry, in France.

Unhealthy sheep-folds, hot weather, extreme cold, crowding, neglect of ordinary hygiènic precautions, fatigue, and improper or insufficient food,—all increase the death-rate. Among lambs, aged sheep, those in lamb, or those which are fat, there is a greater mortality than with others.

This disease causes much destruction at all times, but before inoculation was tried, it appears to have been productive of most serious losses in those countries in which it prevailed. Salmuth calculated that, in Germany, during a period of six years, the average loss was one-eighth of the ovine population; and Liebbold reckoned the yearly mortality from this disease to amount, in Hungary, to 150,000, out of a population of eight millions; and Heintl, for Austria, with a population of sixteen millions, gives it as 400,000. Laubender estimated the annual loss, in Austria and Prussia, at one million sheep.

But, as in other diseases of this kind, the mortality does not represent the entire loss that befalls individuals or the animal wealth of a country. We have observed that Variola does not attack all the animals at once, but affects a flock in three successive periods or starts; so that the malady may exist in the flock for four, five, or six months. During this time, the owner has to conform to restrictions which are onerous and prove costly: the flock must be isolated in a sheep-fold or pasture, and be there fed in a more expensive manner, and attended by more persons than are necessary under ordinary circumstances. In addition, there is the loss occasioned by the depreciation in the value of the wool, the skins, that of the animals themselves, if they recover, by the abortions among the ewes, and by the serious complications which sometimes remain, and which greatly damage the health and value of the sheep that escape.

IMMUNITY.

Variola, as a rule, only attacks a sheep once; the cases in which a second attack has been observed, being extremely rare. It has been stated, and with some show of probability,

that lambs from ewes which were suffering from the disease when pregnant, are protected from its influence during life; but in these cases the fœtus must have been affected *in utero*. That such an occurrence is possible, is proved by the fact that sometimes, though rarely, on the skin of the fœtus of sheep which have died of Small-pox, variolous pustules are seen. Indeed, in the aborted fœtus, as well as in the lambs which have been dropped by ewes while diseased, it is not unusual, according to Röll, to find the characteristic lesions of the malady.

During an outbreak of the disease, all the sheep exposed to the contagion do not become affected; Haubner estimates that about two per cent. are refractory to its influence.

SANITARY MEASURES.

The grave character of this disease, the mortality it causes, the exceptional subtlety of its contagium, the obstacles it throws in the way of sheep traffic, and in the improvement and multiplication of these animals, have for nearly two centuries impressed upon continental governments the necessity for framing laws which might limit or avert its ravages; while sheep-owners have always manifested the most anxious solicitude for the preservation of their flocks from its invasion.

Knowing that its appearance and extension depend upon its contagious properties, prophylactic and sanitary police measures are of the utmost importance in preventing its invasion, or arresting and extinguishing it when it shows itself.

PERMANENT PRECAUTIONARY MEASURES.

As we have already mentioned, in sheep traffic between countries in which contagious diseases prevail, certificates from competent veterinary authorities of the health of the animals so imported, as well as of the sanitary condition of the districts from which they are derived, should accompany the importations; as an inspection on arrival cannot always ensure the discovery of infection, and is expensive and troublesome if thoroughly carried out.

The greatest care should be exercised in allowing the in-

troduction of sheep into a country from places where the disease is known to appear at intervals, or where it is already prevalent. If they must be imported from a locality where Variola exists, the most scrupulous examination should be made—if the importation cannot be altogether interdicted—of each animal; and if the period which has elapsed since their departure is less than the incubatory period of the disease, then—unless they are to be immediately killed for food, and their isolation from other sheep can be thoroughly guaranteed—they should be kept in quarantine, with the usual precautions, until it can be positively ascertained that they have not been infected. The period of quarantine will depend upon the length of the incubatory period of the disease.

PREVENTIVE MEASURES.

When the disease has made its appearance in a country or in a district, every possible care should be exercised in the matter of isolation. The flocks which are unaffected should be kept widely apart from those which are suspected, or in which the disease prevails. Röll recommends that the sheep in poor condition, or in a weak state of health, should be got rid of as soon as possible; as in these the disease generally assumes a malignant form, and, in the majority of cases, has a fatal termination. By adopting this course, their flesh, skin, and wool can be profitably disposed of.

Frequent and careful inspections should be made of the flocks, each animal being scrutinized; so that the disease may be detected without delay, should the contagion have been accidentally introduced among them.

Every precaution should be taken to exclude shepherds, butchers, or other men, animals, or even inanimate substances which, indirectly or directly, may have been in contact with infected animals, articles, or in infected places. Recently-purchased sheep should not be admitted into the flock until after they have been kept isolated for at least two weeks. Purchases at fairs should be rigorously watched.

Pastures, ponds, or roads frequented by diseased or sus-

pected flocks should be avoided. If it be absolutely necessary to resort to these roads or pastures, endeavours should be made not to do so until at least the morning dew has acted upon them, or until rain or heavy damp has fallen.

Should it be necessary to purchase forage, it should be bought in localities free from the disease.

Cleanliness, and good food and water, should be attended to. The food ought not be given in too great abundance, nor yet should it be of a very stimulating kind.

If animals have been exposed to the contagion, they should be washed several times a day for several days, if possible.

SUPPRESSIVE MEASURES.

The preservative measures are not always successful in averting an invasion of Sheep-pox: so subtle is the contagium, and so many are the ways by which it may evade every barrier, and obtain access to hitherto healthy animals.

When the disease appears in a flock, the object then must be to isolate it by every means possible.

1. *Declaration.*

The proprietor should immediately report the existence of the malady in his sheep to the proper authorities, in order that the necessary measures may be adopted without delay. Neglect to do this should be severely visited by fine or imprisonment.

When it is positively ascertained that Variola is present, the circumstance should be made public.

2. *Visit.*

The veterinary surgeon delegated by the authorities to inspect the flock and report upon the outbreak, should ascertain the number of animals in the flock, the gravity of the disease, the number affected and dead, the situation, condition, and nature of the locality, and its relation to the adjoining districts. He should be accompanied by a public functionary; and, if possible, his mission should be accomplished in the presence of this individual, as well as in that of the pro-

prietor of the flock. Inquiry should be made as to the advent and source of the disease, and a personal inspection must be made of the flock. It is well to divide it into three portions, each composed respectively of those yet in health, those seriously affected, and those in the early stage of the malady ; keeping them in separate places. If circumstances will permit, it is a good plan to select from the healthy those which may be deemed suspected. All the sickly or weak sheep should also be weeded out from the former, even should they not present any symptoms of the disease ; as when they become affected they most frequently have the worst form.

On all visits and inspections the healthy should be first examined, then the suspected, and finally the diseased ; and as woollen stuffs are most readily impregnated, and longest retain the contagium, the veterinary surgeon, and those who have to do with the diseased sheep, should wear cotton or silk coverings over their clothes. Every precaution must be taken that they may not be instrumental in spreading the disease.

The veterinary surgeon should inform himself, in the course of his visit, whether reserves of forage are accessible, and if there is an appropriate place for the establishment of lazarets. All this, and other information, will prove most useful in assisting the authorities to arrange for the isolation and extinction of the disease as speedily and effectively as possible.

The diseased animals may be left on the ground they occupied at the first visit ; the suspected and healthy should be moved to other ground, and carefully guarded. All may receive a particular ochre mark on the back or face, to distinguish and identify them, lest they become mixed, or surreptitiously find their way to the butcher or fair.

3. *Isolation.*

Isolation is absolutely necessary to prevent the extension of the disease, and is of the greatest value if properly attended to. Its maintenance requires as rigid observance as in the case of Cattle-plague ; and this measure should be extended not only to the diseased, but also to the healthy and

suspected portions of the flock. Those persons who attend to the sick should on no account go near the healthy, nor have any communication with those looking after the latter; and a strict look-out should be had with regard to strangers, dogs, fowls, &c.

4. *Sequestration.*

Sequestration is only a more rigid form of isolation, and is seldom applicable; inasmuch as the flock is prohibited from moving beyond a certain limited space, either to graze or to water. In the majority of cases, it is such an onerous measure as to be equivalent to sacrificing the whole flock.

5. *Cantonment.*

Cantonment has fewer inconveniences than sequestration, particularly in summer, and is generally meant to signify keeping the flocks in a particular situation away from the highroads, by-roads, and commons; the place, if possible, being well defined by natural limits, such as a river, wood, or valley. If hills or mountains are adjacent, then one or more of these may be chosen for the cantonment of the diseased and suspected, provided there is sufficient pasture, or, if not, a supply of forage in the vicinity. All roads leading to these places, except those intended for the cantoned flock and designated by authority, must be interdicted; and the care of the animals should be confided to intelligent shepherds, who may be appointed by the authorities. If no water is to be found, then watering-places must be made; and should the weather be dry, water must be carried to troughs by the best means available. In bad or hot weather, shelter should also be provided in the form of sheds.

In depasturing the diseased sheep, the conveyance of the contagion by the wind must not be forgotten by the shepherds.

6. *Mixed Cantonments.*

Mixed cantonment is the easiest and least onerous form of isolation when properly carried out, and is always to be pre-

ferred when circumstances permit. When the disease appears in bad weather, as in spring and autumn, or during the hot season, in order to prevent the accidents which might arise from the sheep being kept permanently exposed in the open air, they may be allowed to occupy sheds, sheep-folds, or live in the pasture, according to the temperature. The same regulations must remain in force, however, with regard to limits and the allotted track.

The *duration* of the cantonment or isolation is subordinate, of course, to that of the disease—varying from three to six months, according to the serious character of the malady, and the number of sheep attacked.

In any case, the isolation should only cease by order of the authorities; these will be guided by the reports they receive from the veterinary surgeon, who alone can weigh all the circumstances of the case, and give a trustworthy opinion.

Knowing the long time that an infected flock may harbour the contagion, it may be found an excellent measure to have those which recover, or which may have escaped the malady, disinfected, should the season and other circumstances permit. Washing with soap, and dressing with a weak solution of carbolic acid, may do much towards shortening the period of isolation. If a stream or river is near, the carrying out of this measure is greatly facilitated.

7. *Slaughter and Burial.*

Animals which have the disease in a malignant form should be immediately separated from the others, and at once killed and buried, with skin and wool (the skin is valueless), in a place set apart for that purpose. They should be buried deep, and it would be well to throw a quantity of lime upon them before finally covering them up. All sheep which have died should be interred in the same manner, and in their skins, unless circumstances admit of the latter being thoroughly dried. The wool of sheep affected with Small-pox will come under the same regulation; it should be thoroughly ventilated during at least four weeks before being sold. There is no proof

that dried skins, or well-aired wool, ventilated for this period, can infect healthy sheep.

8. *Disinfection.*

The destruction of the skin and wool is, in all cases, inadvisable, if they can be preserved and disinfected without risk of conveying the contagion, as the loss is thereby diminished. Even in particular cases, the flesh may be permitted to be consumed as food; though this should never be done without the sanction of the authorities.

The manure in the folds in which the diseased sheep have been kept should be conveyed to a remote unfrequented place, and covered with earth; it must not be used until completely decomposed.

The hay or straw which have been near or in direct contact with diseased sheep, should either be destroyed, or well aired for some time, and then given to animals of a species not susceptible of the malady.

The places in which the sick sheep have been kept should not be inhabited by other sheep for some time, unless these have had the disease, or been successfully inoculated. Lime may be sprinkled over the pastures, which should be rained upon for a number of days before other flocks are admitted. Sheep-folds must be left vacant for a reasonable period, well ventilated, and disinfected; the walls should be washed and scraped, and treated with lime-wash. The soil of the floor must be removed to as great a depth as the urine has penetrated, and treated like the manure; it should be replaced by fresh earth. Any utensils employed with the diseased sheep, must be lime-washed and dried in the air.

In special cases, if there is great danger of the disease spreading beyond the contaminated animals, and more especially if the surrounding flocks are numerous, and isolation more than usually difficult, it may be necessary to resort at once to the severe expedient of occision and interment of the diseased and suspected. This rigorous measure would, however, only be justified in particular circumstances: as at the very commencement of the disease, when the loss would not

be heavy, and when the malady makes its appearance in a pastoral country like Australia, New Zealand, or even our own.

9. *Fairs.*

It might even be necessary, in particular outbreaks, to interdict the movement of sheep, and suspend the holding of fairs in the localities where the disease prevails, until it is finally extinguished. But for all practical purposes, when the owners of diseased flocks and others co-operate intelligently with the authorities in the suppression of the contagion, isolation or sequestration, and careful disinfection, will, in the majority of outbreaks, be sufficiently efficacious in preventing its extension.

10. *Compensation.*

If occision be deemed necessary, and is rendered compulsory, the question of compensation for the animals of the flock which are healthy, as well as for those which, suffering from the disease in a mild form, would certainly recover, must be taken into consideration. Liberality in this respect will be economy in the end.*

All the measures connected with the prevention and suppression of the malady should be entrusted for their execution to the veterinary surgeon, on whom should rest the responsibility of averting or extinguishing it, if he is permitted to exercise his judgment to the full.

PROTECTIVE MEASURES.

INOCULATION.

However carefully the sanitary measures just recommended may be carried into effect, and however vigilant sheep-owners and others may be in guarding against the introduction of this disease by adopting precautions and rigorously applying them, success is not always ensured when the malady exists in the

* The Select Committee on the Contagious Diseases (Animals) Act, 1869, recommend that the slaughter of all sheep affected with Small-pox should be compulsory, *with compensation.*

neighbourhood, in consequence of the subtlety of the contagium. There are generally a multitude of ways in which it can be carried to healthy animals, and not unfrequently when it is imagined that everything has been done and every approach guarded, the disease suddenly manifests itself in the anxiously protected flocks. And when this is the case, it is often impossible to prevent it attacking nearly every individual in the flock, notwithstanding the isolation of the sick as soon as detected. Not only is this a serious feature in the disease, but the long time that must elapse before it has attacked the whole flock, and the interval that must subsequently be allowed before the sheep can be declared free from danger to others, makes it extremely harassing and ruinous.

It is to abridge this long period, to diminish the mortality, and thus free an entire district or country from onerous restrictions and heavy loss, that inoculation has been recommended and largely practised on the continent of Europe; inoculation establishments being instituted in different countries, and especially in Austria and Hungary, and the measure rendered obligatory.*

This operation (named *clavelisation* by the French, *pocken-impfung* and *schutzimpfung* by the Germans), was first mentioned by Chalette (Médecine des Chevaux, 1763), in the middle of the eighteenth century, though it had been practised for a long period in Upper Languedoc, France. Its utility is based on the fact that one attack of the disease confers immunity from another, and that the attack thus artificially induced is generally more benignant than that due to natural infection—the inoculated disease being often almost purely local.

It is usually practised by introducing a particular instrument—an *inoculation needle*—carrying a small quantity of the virus, beneath the skin in a convenient region of the body.

* Inoculation has been practised from the earliest times by the shepherds in different parts of France and in Piedmont. The Adrianople sheep suffer from the "tchitchek," a kind of mild Variola; to guard them from it they are inoculated. When the disease is detected in a flock, the shepherd immediately perforates the ears of all the sound sheep with a silver needle, previously rubbed over with virus from the infected animals.

1. *Advantages.*

The advantages of inoculation may be stated as follows:

1. The substitution of a mild form of the disease which guarantees the animals from future attacks, and which only causes a loss of about from two to four per cent., for one which may cause a loss of thirty or forty, or even more per cent.

2. A diminution in the duration of the epizoöty. As has been mentioned, when a flock is affected, all the sheep do not suffer at one time, but at three attacks, each lasting a month or six weeks; so that it is four, five, or six months before the malady has passed through the flock. By inoculation the whole have been infected, and the disease disappears in the great majority of instances, in about a month or five weeks.

3. The time for operation can also be chosen, unless the disease is already among the flocks, and the most favourable conditions secured—such as the time of year, temperature, locality, age, health and condition of the sheep, their pregnancy, &c. Thus the serious accidents which attend the natural disease when it appears during the winter or very warm weather, in folds, or during pregnancy or suckling, &c., are avoided.

4. The mild disease induced by inoculation requires but little hygiènic or medical interference; the sheep do not require to be specially fed, and they may be allowed to pasture as if in health, only avoiding exposure to extremes of temperature.

5. The inoculated sheep suffer but little, their appetite and condition being slightly, if at all, impaired in the majority of cases; and they may be sold for food soon after the desquamative stage has been passed. The pustules being few, and isolated on the surface of the skin, the wool is not injured.

6. Sanitary measures, which are always so onerous to commerce and harassing to proprietors, can be dispensed with altogether if all the sheep are inoculated, as they are no longer susceptible to the action of the contagium.

2. *Disadvantages.*

Though inoculation with the object of producing Variola in a mild form, and thus preventing much loss and anxiety should

the disease appear among uninoculated sheep, has been largely practised on the continent, and has been recommended by the most experienced veterinary authorities; yet, from time to time, writers have alluded to its disadvantages as a general measure. It has been said, for instance, that:

1. The disease is given to animals which would not, perhaps, have had it at all.

2. It is capable of producing as deadly and malignant a form of the malady as that due to natural infection.

3. It causes loss when performed at certain times; retards the growth of the lambs by diminishing the secretion of milk in the ewes, and often interferes with the selling of the animals at a favourable opportunity.

4. It is possible in certain countries, and in particular localities of other regions, to preserve the sheep from infection by isolation, quarantine of foreign flocks, &c., and that to introduce the disease into these places, and infect all the sheep therein, is hurtful and unnecessary.

The last-named objection is perhaps the most worthy of notice, and in such a country as our own, where a careful inspection, quarantine, or other measures, are possible at the defined ports for the admission of foreign sheep, it must be admitted to have very great weight. Fürstenberg declares that, in Eastern Prussia, thousands of cases of infection could be traced from inoculated flocks, which were so many centres of contagion from which the malady might radiate in every direction, and that in many countries the malady was only maintained by this practice. So serious have the results of preservative inoculation been found that the special establishments have, I believe, been abolished in those countries which instituted them. But, on the whole, it may be said that the objections apply less to inoculation itself than to the circumstances in which it might be practised. The authorities must take into consideration those circumstances, and sanction or disapprove of this measure according to the exigencies which present themselves.

It will generally be found that the danger of diffusion of the contagion offers a formidable obstacle to inoculation. Each

inoculated flock is a centre of contagion for neighbouring flocks; and if inoculation becomes compulsory or general, the disease reigns permamently: as has happened in Eastern and Western Prussia, Pomerania, parts of Austria, and the islands in the Baltic, where, according to the graziers, "the disease is in the air." Fürstenberg states, as has been mentioned, that in Eastern Prussia, not hundreds but thousands of cases might be cited in which the malady has extended from an inoculated flock over a vast region, and that in many countries the disease is maintained solely by this operation; the sums lost in consequence, he adds, must be enormous, and for the Government of Stralsund alone, in 1866, he computed the loss as amounting to nearly 50,000 francs.

LOSS.

The loss in animals from inoculation varies to some extent at different seasons, among different breeds, and also in different countries; but it may be said that, where due care is exercised, it is insignificant. According to D'Arboval, with 32,121 sheep successfully inoculated, there were only 270 deaths; or about three in 400. The Marquis de Barbançois gives one per cent. in a total of 4062 in 1806; and in 1820, of 3150 inoculated, 19 died. At another period he had 8200 inoculated, 2000 of which were lambs; and the mortality was one per cent. Delafond gives three per cent. in 10,416 inoculated sheep selected from flocks attacked by the disease.

According to M. Gayot, while in Marne and Upper Marne the malady in an epizoötic form was carrying off twenty per cent. of the infected, the loss was only two per cent. in about 10,000 inoculated sheep. From 1822 to 1824, Guillaume, a veterinary surgeon at Issoudun, practised inoculation at all seasons of the year. Out of 10,568 sheep, 1183 (about one-tenth) were attacked by the disease, and 638 of these succumbed (more than one-half). He inoculated the remaining 9443 which had been exposed to the contagion, and only lost one in 674.

Miguel and Thomières inoculated 17,044, of which about one half were affected with Variola, and the inoculation of those yet healthy was successful. In a flock of 300 sheep, 40

of which were ill, there was no loss; but in another infected flock, placed in the same conditions, there was a serious and most exceptional mortality: for of 65 apparently healthy animals, 5 died. Reynal gives the loss in 10,000 as averaging two per cent. Other French veterinarians and agriculturists have given equally favourable reports, the mean being 1.120 to 1.150 per cent.

In Germany, the benefits derived from this operation have been as conspicuous. According to the statistics published by Weilh, of Vienna, in 1840, the mortality never exceeded 2 to 2½ per cent. in Austria and Hungary. Holmeister states that the inoculation of 8,000 lambs and 2,000 sheep did not entail any loss. Müller gives one per cent. mortality in Austria.

In Prussia, out of a total of 66,716 inoculations, the loss was 1674; or 2½ per cent.

PRESERVATIVE INOCULATION.

Preservative inoculation is practised annually in those countries in which the ovine Variola frequently appears. The lambs are inoculated whether the malady be prevailing or not. The loss it occasions is exceedingly trifling, as the most favourable seasons—spring and autumn—can be chosen, and the animals can be selected at the best age (usually when they are a few months old).

Nevertheless, as already remarked, this preservative inoculation is not to be recommended unhesitatingly in those localities or countries from which the contagion can be excluded, or in which it has not been seen, or does not appear; as keeping the virus in an active state all the year round is a source of permanent danger, so far as the propagation of the disease is concerned.

According to Röll, preventive or preservative inoculation is gradually being abandoned, even in those countries in which the malady often appears; apparently for the reason that the inoculated disease, like that arising from natural infection, generates a volatile virus which may cause a general and unintentional outbreak of Variola in the flocks, and thus occasion serious loss. The accidental transmissions have most fre-

quently taken place during the preparatory inoculations for procuring a sufficiency of the virus to inoculate with.

The places where this preservative inoculation is performed yearly, are always centres from which the disease may be accidentally carried to neighbouring flocks. It is therefore essential that this operation be not performed anywhere without authority: and even when this is obtained, the inoculated flock, while suffering from its effects, should be submitted to the same measures as if contaminated in the natural way.

PROPHYLACTIC INOCULATION (*Vorbauungsimpfung*).

This inoculation is resorted to in those cases in which the disease prevails in the neighbourhood, and there is no likelihood of escaping from it by the most careful measures of sequestration, &c. Of course, this preventive inoculation has much less chance of success, so far as loss is concerned, than the other; as there is generally no time to wait for a favourable season, to estimate the sanitary condition of the flock, or other considerations which influence the result of the operation.

COMPULSORY INOCULATION (*Nothimpfung*).

This designation has been given to the inoculation of sheep which are apparently in good health, and is practised when the disease already prevails in the flock. Its results are even less satisfactory than those of prophylactic inoculation; as many of the animals may, at the moment of inoculation, be already under the influence of the virus received in a natural manner, and will have the disease in the ordinary way. Nevertheless, the operation is to be recommended in certain circumstances, inasmuch as the duration of the epizoöty in the flock is abbreviated, and a number of the sheep may have the malady in a more benignant form.

INOCULATION VIRUS.

The virus wherewith to inoculate sheep, with the object of inducing a benignant form of the disease, is obtained by

preference from the transparent lymph of a vesicle or pustule which has reached its maturity: inoculation with the blood, pus, or crust being discontinued.

The variolous lymph is derived from pustules which have been developed by previous inoculation, and have become mature (generally in ten or fourteen days after inoculation or infection); or from those resulting from natural infection. It is collected from those animals which are young and vigorous, in moderate condition, which were previously in good health, and which are but slightly affected; in these the pustules being few, well developed, and regular in their course. The best type of pustule is one which is circular or oval in shape, prominent, and well formed; which is detached without difficulty or pain, with the skin, from the subjacent parts; which is slightly pale at its circumference and on the surface; and the investing pellicle of which is easily removed.

Good lymph exudes naturally from the surface of the pustule, or flows from the incisions made therein, as a colourless, or slightly reddish, transparent fluid.

Cultivated Virus.

In order to procure a quantity of virus sufficient to inoculate a considerable number of sheep, it is frequently necessary to have recourse to a *preliminary inoculation*, by which a number of perfectly healthy, strong animals are infected; the lymph collected from them is used for inoculating others. Many years ago it was observed that repeated transmissions of the virus by inoculations modified its virulency, but without diminishing its protective value: the lymph obtained from a sheep naturally infected causing a greater febrile reaction, and a more severe eruption, than that which had been passed by inoculation through several generations. With the lymph from a young and strong sheep suffering from a benignant, but naturally-induced, form of the disease, a number of young, healthy sheep—say ten or twelve, according to the quantity of lymph required—are inoculated. Among these a selection is made of those animals which have the least numerous, finest, and best developed pustules; and from them are inoculated

another ten or twelve healthy sheep. From these, again, a similar choice is made, and an equal number of animals inoculated. At each inoculation the number of pustules is less, until, finally, the successive transmissions have produced only one pustule of an excellent kind. This is an indication that the virus has arrived at that stage when its inoculation will always produce a very benignant form of the disease. That it is very improbable the virus ever becomes inert in these transmissions, is somewhat proved by the fact that the same lymph has been employed at the Vienna Veterinary School from 1836 to 1845, being transmitted thirty-three times every year, or a total of 297 transmissions, without losing its virulent and preservative properties.

These advantages have led to the establishment, in countries which are often visited by the disease, of certain institutions where, all the year round, inoculations are practised on a limited number of sheep; so that, according to emergencies, there are always two or more under the influence of the disease. The lymph collected from them is partly used to make new inoculations, and the remainder is preserved in a convenient manner from the air—as in small phials, capillary tubes, between plates of glass, &c.—and kept in a dark place until required in a large quantity.

Though the extensive experience of many of the most trustworthy veterinary authorities has proved that the cultivated virus derived from the successive inoculations of healthy animals only produces, as a rule, a Variola localized in the region into which it has been inserted; yet from observations continued at the Vienna Veterinary School for twenty-seven consecutive years (up to 1864), it has been noted that though, in general, a local Variola is due to this cultivated lymph, yet that at times a general eruption may result.

Röll also states that the lymph obtained direct from sheep naturally infected, if the inoculation has been properly performed, will most frequently only produce an eruption confined to the inoculated region.

He also adds that this so-called "cultivation" cannot be said to mitigate the action of the virus, but must be looked

upon as chiefly valuable for preserving it in sufficient quantity for the purpose of inoculation, in countries exposed to the frequent invasion of the malady.

As the cultivated virus still possesses the property of infecting healthy animals, through the medium of the air and otherwise, and as the Variola thus induced is as serious in its character as the ordinary natural type; this cultivation should not be permitted without authority, and should even then only be tolerated in special establishments remote from sheep-pastures, and from which there is no danger of the contagion being conveyed accidentally.

RULES FOR INOCULATION.

In compulsory or necessary inoculations, when an entire flock is threatened with an immediate attack of the disease, but few rules can be observed; but in preservative and prophylactic inoculations, it is advantageous to observe certain prescriptions which influence the result of the operation. These are related to the condition of the sheep, their age, and the season of the year.

Perfect health being an essential condition towards success, weakly animals, or those suffering from any organic or debilitating disease, should not, if possible, be inoculated. Neither, except in cases of urgent necessity, should the operation be practised on pregnant ewes, lambs, at the period of shearing, or that of rutting. Very fat sheep are also not likely to withstand the effects of the artificial disease so well as those which are in moderate condition.

With regard to age, it is preferable to have the lambs weaned before they are inoculated; after that period, age does not seem to have much influence on the course of the malady. Though the lambs may have come from ewes which were suffering from the disease, yet inoculation must not be neglected on that account. Girard states that he successfully inoculated, some time after their birth, two hundred lambs born from affected ewes.

The season has an important influence on the character of the inoculated disease. Mild, regular weather, with an absence

of rain, is the most propitious. Therefore it is, that, on the continent, the spring and autumn are preferred. In such a climate as that of England, probably the autumn would be selected.

In compulsory inoculation, of course the season cannot be chosen, and, if unpropitious, its disadvantages must be compensated by hygiènic measures.

Before undertaking the operation, some preparatory arrangements are necessary, in order to facilitate its performance, accelerate its course, and render the task easier for the operator and his assistants. To this end, it is well to have the locality so disposed as to admit of the inoculated being isolated from the non-inoculated. This measure is absolutely necessary, for, as we have said, the disease can be propagated from inoculated animals in a natural manner, and indirectly by the air and other media. Hurdles, sheds, and sheep-folds, may be utilized with this object.

The Operation.

The operation of inoculation is simple. A suitable region, destitute of wool, is first decided upon, and the lymph is introduced either by incision of the skin, abrasion of the epidermis, setons, punctures, or by the stomach.

With regard to the region, the tail, or the inner side of the thigh or ear, are usually preferred, as they are most removed from friction, and for other reasons. Of the three places, the tail is the most convenient, and is not nearly so liable to those accidents of a gangrenous kind which sometimes result from thigh inoculation. But if the tail has been closely amputated, the thigh or inner aspect of the ear must be selected.

Puncture is preferable to all other modes for the introduction of the virus into the blood. Any sharp instrument may be used; but the best, perhaps, is a fluted needle, as the lymph can be deposited beneath the epidermis by a very minute opening, and does not cause bleeding, nor does it produce a sore or inflammatory swellings.

The animals are fixed in the following manner: If the inoculation is to be made direct from the sheep which bears

the pustule, that animal is thrown down and fixed on two bundles of straw tied together by a cord, to the right of the operator. If the inoculation is to be practised on the inside of the thigh, the sheep to be operated upon is placed on its back on two bundles of straw or on a table immediately in front of the operator, who seizes the hind limb which is at liberty (usually the right), compresses it above the hock in pulling the skin outwards, so as to make it tense at the seat of puncture. This mode requires a number of assistants if there are many animals, and if it is desired that no delay should occur. An animal should be always secured and ready to be operated upon as soon as one has been inoculated, and an assistant should be at hand charging a needle with the virus.

If the tail is chosen, two modes may be adopted: The sheep may be thrown down and held by an assistant on a bank or on straw, in such a way that the tail shall be towards the operator, its under surface, destitute of wool, being uppermost. Or the animal may be kept standing, its head held between the legs of the assistant, who seizes it by the wool on its back and presents its croup to the operator. The latter, stooping slightly, catches the tail, turns it upward over the back, and inserts the charged needle beneath the epidermis at two or three inches from the root.

If the ear is to be inoculated, the sheep is placed on its side or seated at the left of the operator.

Whatever region be chosen, the charged needle is to be introduced beneath the skin, its fluted side upwards, and when it has penetrated to the depth of a line or a line and a-half, it is turned round, slight pressure being made on its sides by means of the surrounding skin, to ensure its being deprived of the lymph. If the epidermis is torn by the needle, it will be necessary to make a new puncture.

COURSE OF INOCULATED OVINE VARIOLA.

The course of the inoculated disease differs but little from that of the natural Variola in a very benignant form. The inoculated sheep, immediately after the operation, should be

somewhat carefully attended to, so far as temperature, good food or pasture, a sufficiency of salt, and plenty of fresh air are concerend. Nothing more is necessary. From the third to the fifth day after the operation, the inoculated part must be examined, and those animals which do not manifest any signs of having been successfully inoculated should be separated from the others, and subjected to another trial.

In those which have received the virus, towards the end of the first or second day nothing can be seen of the puncture. About the third or fourth day—later, perhaps, if the weather is cold—there appears a small red point, which in the following days becomes a hard deep-red nodule; the epidermis covering it is raised in consequence of the serous deposition going on beneath, which thus transforms the nodule into a vesicle of variable dimensions, areolar in structure, and umbilicated in its middle. From the ninth to the eleventh day, the vesicle or pustule has attained its maximum development (from half an inch to an inch, or even more, in diameter at the base of the tail); at this period it is of a bluish-white or yellow tint, and, if punctured, a clear, colourless, or pale-red, stringy fluid flows from it. If the weather is cool, the pustule remains in this state for one or two days; but in hot weather it alters in a few hours, the contents become rapidly purulent, and the pustule soon dries up, leaving a dark-brown or black scab, which becomes detached at its edge about the twentieth to the twenty-fifth day, not long after which there only remains a hard, often stellate cicatrix.

The fever which precedes and accompanies the eruption due to inoculation is usually very slight, and in young animals not unfrequently passes over unobserved; generally there is only one vesicle, which appears at the point inoculated. Sometimes, however, there is no eruption there; but, instead, there is a number of pustules around it, which are ordinarily smaller than the single one, and resemble those of the natural eruption. In other cases, also, though rarely, a general eruption appears, whether or not a pustule has been developed at the seat of inoculation.

ACCIDENTS SUPERVENING ON INOCULATION.

Several accidents are described as following inoculation, and depending upon a variety of circumstances. The chief of these appear to be gangrenous swellings and tumours, which show themselves usually from the twelfth to the twentieth day after the operation: becoming developed at the point of inoculation, and especially when the puncture has been made on the inner side of the thigh, where there is an abundance of cellular tissue, vessels, and lymphatic glands, and where there is much friction during motion. Inflammation of the lymphatic vessels, particularly if the virus is impure, sometimes occurs; it is denoted by a hard cord passing towards the lymphatic glands, and marked at certain intervals by nodules on its course. The desquamation of the pustule is now and again accompanied by sloughing of the skin and an unhealthy ulcer. Tetanus has also been witnessed, from the twenty-fifth to the thirtieth day after inoculation.

CURATIVE MEASURES.

When an animal has become infected, and the virus has begun to exercise its power, the disease will run its course in spite of all medical treatment. The treatment can, therefore, only be symptomatic—placing the sick in as good conditions for recovery as possible, giving proper food, and modifying any urgent symptoms, or treating serious complications which may appear, by appropriate remedies. Hygiènic measures hold the first place in curative treatment, and when the attack follows a regular course, as a rule nothing more is needed than the observance of these: the administration of medicines nearly always doing harm.

Overcrowding should be avoided by every means, and if the sheep are housed, plenty of fresh air ought to be allowed them, though draughts should be guarded against; an equable, but not a high temperature should be maintained, and litter allowed; in warm dry weather, they may be permitted to pasture, but they must not be exposed to cold and damp. To

strong well-bred sheep, the allowance of food should be diminished—that is, it should be given in moderate quantity, and if possible in an undried condition (turnips, clover, cut potatoes, &c.), to which a small quantity of salt might advantageously be added; fresh water should be plentifully given, and in this it will be generally beneficial to dissolve, according to circumstances, a little sulphate of soda or sulphate of iron; or in some cases good will result from the addition of merely a little vinegar or sulphuric acid. Rock salt should also be placed where the animals may easily reach it; and the weakly sheep may have their strength sustained, in addition, by oatmeal or barleymeal gruel at a tepid temperature, and more particularly in those cases in which the lips and throat are much involved. Should constipation be present, enemas of soapy water must be given.

In convalescence, should the sheep be much debilitated and wasted, good and abundant food must be given, with plenty of salt, and astringents and tonics.

In the malignant or irregular form of the disease, treatment is scarcely worth adopting, unless the sheep are very valuable, and reasonable hopes of their recovery are entertained. The flock should be divided into lots, keeping those which are in certain stages of the malady by themselves, and those also apart which are most severely affected and require most care. Medical treatment of these will depend upon individual indications, and no fixed rules can be laid down. In the majority of cases, tonics and stimulants will be required. When the fever threatens to be very intense and the eruption confluent, the diet should be diminished and the drink acidulated or rendered slightly laxative. If the eruption is slow in developing itself, alcoholic draughts and warm aromatic infusions may be administered. Hay infusion (*hay tea*) is easily and cheaply made, and proves most beneficial. A similar treatment is required when the eruption disappears suddenly.

The cutaneous eruption requires but little attention. The sores should be treated as simple wounds; cleansing them, if confluent, with tepid water, and dressing them with a very weak solution of carbolic acid, alcoholic tinctures, detergents,

&c., as circumstances may require. Particular care should be taken to remove gently the inspissated mucus from around the nostrils, as the crusts it forms render respiration difficult. Painful pustules on the eyelids, eyes, lips, nostrils, or any other part of the body, may be treated by fomentations and soothing lotions. When they are numerous on the tongue, gums, palate, and back part of the throat, emollient and astringent gargles may be had recourse to. Tumours and gangrenous swellings may be relieved by scarifications, leeches, cauterization, or the application of ammoniacal liniment (one part of ammonia to eight parts of oil). The nose and mouth should be frequently sponged with vinegar, or salt and water.

The diarrhœa which sometimes ensues towards the later stage of the disease, is best treated by small doses of alum in solution or dissolved in the gruel, or by any vegetable astringent. Dysentery will require opiates, in combination with astringents.

Other complications must be treated according to their character. When the malady reaches an extreme degree—when the ulcers are numerous, and diarrhœa or dysentery, or other serious indications are manifest—it is judicious to kill the animals, and bury them deeply, with their skin and wool, in an isolated place.

It may be objected that this medical treatment of irregular Small-pox is extremely difficult when large numbers of sheep are attacked. But it is only recommended to be adopted in special circumstances: as when isolation can be perfectly ensured, so as to prevent the extension of the contagion; when the sheep are very valuable, &c. A zealous sheep-owner whose efforts are seconded by an intelligent shepherd, and who treats the worst cases—those placed apart—methodically, will not have much difficulty in carrying out curative measures.

THE FLESH OF VARIOLOUS SHEEP AS FOOD.

The flesh of sheep which have perished from, or been killed in consequence of being affected with, Variola is, from all the evidence hitherto produced, perfectly innocuous when used as

food by human beings and carnivorous animals. This flesh has been consumed in country districts, by shepherds and others, when the disease has prevailed, and no evil results have been noted; it has been sold surreptitiously by butchers during epizoöties of the malady, and no bad consequences have in any case been traced to its consumption; and it has been eaten experimentally, even when the sheep from which it was obtained have been suffering from the worst form of the disease, but nothing untoward was experienced.

During the siege of Paris in the late Franco-German war, the disease at an early period showed itself among a great number of sheep in different parts of the city, and the majority of those which were not infected in a natural manner were inoculated. All these sheep were consumed as food by the population, without any accident being observed that could be traced to this cause.

Nevertheless, should it be decided to sanction the utilization of this flesh as food, it should not be issued for public consumption without authority, and without due care being taken that its transport does not extend the disease to healthy flocks.

Circumstances might arise in which the use of such flesh might not only be permitted, but become absolutely necessary. It is as tender and savoury, and as good in quality and easy of digestion, as that from healthy sheep, according to the testimony of competent authorities. It does not differ from the latter in respect to colour, smell, taste, consistence, or other physical qualities. Sometimes, though extremely rarely, it is said to have a mawkish unpleasant odour. The infrequency of this, however, may be ascribed to the fact that, in by far the larger number of cases, the effects of the disease are confined to the skin and the mucous membranes, and that the muscular system is not implicated.

From the above description of the flesh of variolous sheep, it will be seen that it may be sold surreptitiously without much chance of detection, if it has been dressed by an expert butcher. The odour, in certain cases, particularly if the meat is fresh, might give rise to suspicion; the inflamed or highly congested condition of the lymphatic glands, if any remain,

might also be accepted as proof; and the mucous membrane of the head (eyes, nostrils, and mouth), if that part of the body is present, would be still more conclusive. Most decisive of all evidence, however, would be the condition of the skin, should that covering be found; as the chief effects of the malady are localized there.

HORSE-POX.

SYNONYMS—Technical: *Variola equina.* English: *Grease, Constitutional grease, Loy's disease, Sore heels.* French: *Variole du cheval, Rhinite pemphygoïde, Farcin local, Farcin volant, Stomatite aphtheuse, Javart varioleux, Grease pustuleux, Horse-pox, Herpes phlyctenoide, Maladie vaccinogene.* German: *Pferdepocken, Mauke.* Italian: *Vaiuolo cavallino Vaiuolo equina, Giardone, Giavardo cavallino.* Hindostanee or Bengalee: *Gootry, Goru boshunto.*

GEOGRAPHICAL DISTRIBUTION.

It is extremely probable that this equine Variola is pretty generally diffused in the different parts of the world inhabited by the horse, the Cow-pox (which is believed to be derived from it) being known in both the Old and New Worlds. It has, however, only been perfectly recognized and described in Europe within a recent period: England claiming the distinction of being the first to distinguish it, and to indicate its relation to Cow-pox, as well as its efficacy as a preservative from human Variola.

CHARACTER.

This is an eruptive vesico-pustular malady; the eruption being preceded, in the majority of cases, by a degree of fever so slight as to be almost imperceptible. The eruption may appear on the skin in different regions or over the whole of the body, on the nasal or buccal mucous membrane, and exceptionally on the conjunctival membrane of the eyes. It most frequently appears on the skin, and is most liable to become confluent towards the lower extremity of the limbs and the inferior part of the head. The nasal eruption is nearly always

accompanied by a similar outbreak around the nostrils and on the lips. It not unfrequently appears in an epizoötic form.

CAUSES.

Nothing is known as to the causes which operate in producing this malady, beyond the fact that it is contagious.* A neglect of hygiène doubtless tends to maintain and disseminate, if it does not originate, it. Various authorities have given, as causes, change of climate; cold, wet weather, particularly in the spring; and insolation. The direct and incontrovertible causes are, however, contagion and inoculation.

NATURE.

The Horse-pox is an eruptive, contagious, and febrile disease of the variolous type, transmissible from the equine to the bovine species, and producing Vaccinia in the latter. It is also transmissible to mankind, either directly from the horse, or indirectly through the cow, and acts as a preservative from Small-pox. Its character and nature were first pointed out by Doctor Loy, of Pickering, Yorkshire ("Account of some Experiments on the Origin of Cow-pox," 1802), who was a contemporary of Jenner.

SYMPTOMS.

In recent years, the Horse-pox has been repeatedly observed and described by eminent continental veterinarians and

* Several medical authorities have asserted that this equine Variola is only that of man; the objective differences in the former being attributed to the particular organization of the horse. The experiments of Chauveau have, however, completely refuted this opinion. Numerous inoculations with human Small-pox lymph have only produced, in the cow, papular pustules which had no analogy with those of Cow-pox or Horse-pox, and the lymph of which, inoculated again on man, has induced Small-pox, not Vaccinia.

Reynal notes, nevertheless, that the transmission of human Small-pox to animals is possible, especially with the pig. That eminent veterinary authority has seen the disease communicated to a pig, by linen which had been used by a person suffering from this malady. There are numerous instances on record of certain animals suffering from Variola at the same time as the human species.

medical authorities; and though it appears to be less frequent in England than formerly, if we are to judge by the paucity of reports of its occurrence since Doctor Loy so ably described it, yet there can be no doubt that it is often prevalent, though undistinguished or unrecognized.

Three or four days before the eruption shows itself, there is a more or less slight amount of feverishness, with diminished appetite and increased thirst. When the integument is to be the seat of eruption, the earliest manifestation is observed in those parts of the skin which may be destitute of pigment; there appears a red patch which soon becomes a lenticular prominence, which, when felt between a raised fold of the skin, gives the sensation of an indurated nodule. Becoming more developed, it assumes the shape of a disc depressed in its centre and raised at its margin, while its colour is bluish-gray, surrounded by a bright red areola. Where the skin is stained with pigment, of course the changes in colour are not noticeable; though the pustule has the same umbilicated appearance, and the tint is a little brighter around its circumference, than the other parts of the integument. This feature in the eruption of Horse-pox is characteristic of the variolous pustule in all creatures.

In three or four days, the pustule begins to become flattened; and the epidermis, thickened and dry, forms a crust standing above the level of the skin, and black, gray, or yellow in colour, according to the natural tint of the integument. For three or four days after the umbilicated disposition has disappeared from the pustule, the deeper surface of the crust remains very moist, and the mass is easily detached: leaving a small, circular, and finely granulated red or gray-coloured sore, depressed in the centre, and from which exudes an abundance of very limpid citron-tinted serum. When this exudation diminishes, it forms a yellow irregular crust slightly adherent to the surface of the wound, and beneath which a certain amount of serum yet continues to be secreted.

Towards the eighth or ninth day after the formation of the pustule, the exudation has greatly subsided. Should the crust not have been forcibly detached, cicatrization ensues

without suppuration; the crust remains firmly attached to the epidermis until about the fifteenth to the twentieth day, when it separates, leaving only a little depression covered by a newly-formed epidermic pellicle, through which appears the rose-tinted corium. In this natural desquamation, the crusts are essentially formed by the epidermis; consequently, there is always observed a tuft of hairs implanted in their mass. But if cicatrization of the pustule does not occur until after the epidermic layer covering it has become detached—as happens when the eruption is very confluent and the crusts, instead of remaining adherent, are softened and destroyed in the midst of the humoral flux which flows from the mass of mature pustules—the purulent secretion succeeds that of a greasy nature, to which the malady has at times owed its common, but erroneous designation. Each pustule in this case becomes pyogenic, and in a period varying with the region and the multiplicity of the eruption on a circumscribed surface, it is covered by a crust formed partly by the fluid it secretes, and partly by the superficial layer of the granulations; it is beneath this closely adherent crust that the work of cicatrization gradually proceeds from the periphery towards the centre.

When the eruption takes place on a surface exposed to friction or other external violence—as may be the case between the lips, where the pustules are often irritated and broken by contact with hard fibrous food or the bridle-bit—the lymphatics frequently become inflamed, and multiple abscesses may even form along their course, with tumefaction and suppuration in the glands to which these pass. In such cases, the pustules become ulcers when mature; they also rapidly become pyogenic, increase to the size of a nut or larger, and appear excavated, with everted borders; the fluid they secrete is abundant and oily in appearance, drying into soft crusts, which are completely detached from the surface they cover. If the pustules are confluent, they soon coalesce from ulceration: thus constituting a large sore with an indurated base, that so closely resembles Farcy as to have been, and to be even now, frequently mistaken for it; more especially is this likely to be the case

when the lymphatic vessels and glands are inflamed consecutively to the ulceration of the pustules, and abscesses form along and in these.

Though these pustules of Horse-pox usually resemble each other in shape, no matter on what part of the body they may appear, yet they differ in size according to the regions they may occupy. Generally those on the trunk are the smallest and most disseminated; so that their presence is readily overlooked if a visual examination only is made; though nearly always their whereabouts is betrayed by the little erect tufts of hair that mark their existence. Touch enables their location to be at once ascertained.

On the fine skin covering the inferior extremity of the head —on the muzzle, around and between the nostrils, on the lips and cheeks—the pustules are usually the size of large and small peas, which they still more closely resemble in shape and colour when the epidermis begins to dry on their surface. Their eruption in these situations is very frequent, and sometimes they are discrete, at other times confluent.

It is on the lower part of the limbs—from the knees and hocks to the feet (especially the posterior limbs), and more particularly in the hollow of the pastern—that the so-called "grease-pustules" are most numerous and largest in dimensions; and the complex phenomena by which their presence is characterized, readily explains why they were for so long a period, and are still, confounded with the non-specific disease of the skin of this part, vulgarly known as "grease" (French, *Eaux aux jambe;* German, *Mauke*). From the moment when the eruption is about to appear, the inferior part of the limb becomes tumefied, and painful to the touch as well as during motion. If the skin happens to be destitute of pigment, it is speckled with bright-red patches, each of which becomes raised, and develops a pustule that passes through the phases already indicated. If the hand is passed over the skin of the limb at this period, a multitude of nodosities closely placed will be immediately perceived. When these nodosities have matured into pustules, and simultaneously reached their period of secretion, the skin, as far as the eruption extends, appears

to be transformed into a kind of sieve by the openings through which the limpid, slightly citron-coloured, fluid pours in abundance. At the same time the hairs stand bristling up from their inflamed base, and, becoming agglutinated, allow the fluid part of the serosity with which they are impregnated to drop from the end of the tufts they thus form: the more concrescible portion of the discharge forming a viscid layer on the surface of the skin, and concealing more or less the character of the eruption. This abundant discharge from the pustules, on exposure to the air, rapidly decomposes, and emits a very marked ammoniacal odour: another circumstance which leads to the disease being mistaken for "grease."

Such are the different forms the eruption assumes on the skin: everywhere the pustule has the same characters, and passes through the sames phases; but when it forms part of a close cluster, the abundance of the fluid which bathes it prevents its cicatrization in the manner described when it is isolated; for at an early period it loses its epidermic covering, and the exposed tissue becomes pyogenic.

The buccal eruption of Horse-pox is at first characterized, in its simplest form, by the presence, on the lining membrane of the mouth, of small vesicles about the size of a pea, some circular, others elongated, and whose rosy opaline tint contrasts markedly with the bright-red hue of the mucous membrane on which they are placed. These vesicles are smooth on their surface, and do not show any central depression; in colour and shape they are not at all unlike pearls. To the touch they feel lumpy, and pressure on them causes the animal pain. They may be confluent or discrete, and are observed on the inner aspect of both lips, the inferior surface of the tongue and the borders of its free portion, the inner face of the cheeks, the gums, the commissures of the mouth, especially along the Whartonian ducts, and at their orifices.

When these buccal vesicles are opened, either naturally or accidentally, there remain little round or lenticular sores with sharply-defined borders, finely granular at the bottom, and deep-red in colour. Accompanying this eruption is a very copious salivation, and a slight, but painful, tumefaction of the

submaxillary glands. The animal is a little dull, and eats with less avidity than usual, partly owing to the pain attending mastication. It must be observed, however, that these symptoms are generally so slight as to attract little, if any, attention.

It is very rare that the eruption remains confined to the mouth ; in most cases it extends at the same time to the lips, the end of the nose, and around the nostrils, and this extension gives the disease a more precise character. In other instances, the eruption in this region coincides with the appearance of pustules of the same kind on the trunk, or concentrated on the lower part of the limbs. This coincident eruption is, of course, the expression of the same general morbid condition ; but there are cases in which the eruption of the pustules in different regions, at about the same time, is manifestly due to the successive inoculations the animal performs on itself. Thus a horse whose mouth is affected, may easily transplant the virus by gnawing any part of its body which happens to itch ; while another, which licks or bites a part of its skin covered with mature pustules, may have its mouth and lips affected in consequence.

The apparently vesicular pustules appearing in the mouth of an animal affected with Horse-pox, are small and extremely superficial, and leave no scar after they have disappeared : the slight sore that remains after the escape of their limpid contents readily heals, and in a few days nothing is to be seen.

The nasal eruption is announced by an uniform vascular injection of the lining membrane, and soon afterwards the appearance of small circumscribed patches of a still deeper red, over which the epithelium quickly rises, through the accumulation beneath it of a limpid serosity. These vesicles are very transparent when first formed, and vary in volume from the size of a pin-head to that of a pea ; they are surrounded by a very bright-red areola, which throws them into stronger relief. In about twenty-four hours, the fluid they contain becomes turbid and milky-looking, and gives them a yellow colour ; then the epithelium forming their envelope ruptures,

the contents escape, and only a very red, superficial, circular erosion remains. In less than twenty-four or thirty hours the epithelium is regenerated, and no vestige of the eruption is apparent.

These nasal vesico-pustules are observed, either in the isolated or confluent condition, on the septum of the nose, the inner wing of the nostril, and in one or both nostrils at different times or simultaneously. Generally, their evolution is accompanied by an abundant catarrhal secretion, in the form of a muco-purulent, yellow, thick, and glutinous discharge, that adheres to the orifice of the nostrils, and may conceal the characters of the eruption: thus leading to errors in diagnosis.

This nasal eruption is nearly always coincident with a doughy, and somewhat painful, swelling of the submaxillary lymphatic glands; not unfrequently the animal exhibits a general, but ephemeral, disturbance of health: marked by dulness, diminished appetite, slight languor, quickened pulse, increased temperature, and dull coat; all this disappears as soon as the eruption has completed its phases.

It is quite exceptional that the eruption remains localized on the nasal membrane; more frequently pustules are developed around the nostrils and the lips, and even over the whole of the body: thus giving an unmistakable aspect to the malady.

COURSE AND TERMINATIONS.

The course and terminations of Horse-pox are generally favourable. In many cases the general health is little disturbed, and convalescence is rapid. The duration of the disease, unless complications occur, is brief; and it may be said that, as a rule, the Variola of the equine species is a benignant malady.

The first stage, that of invasion, is about three days; the second, or eruptive stage, from six to eight days; the third stage, the desquamative, continues from six to nine days: the duration of the disease being generally from fifteen to twenty days. About this time the crusts begin to fall off, and in three or four days have completely disappeared. In excep-

tional cases, the ordinary duration is prolonged, owing to the appearance of a secondary eruption, which lasts as long as the first.

The confluence of the pustules on the lower part of the limbs, where the skin is thick, may give rise to such an accident as partial necrosis of that covering and the subcutaneous tissues, such as the lateral cartilages and other structures in this region, with separation of the whole or a portion of the hoof, the formation of fistulæ, &c.

PATHOLOGICAL ANATOMY.

There is nothing particular to note with regard to the pathological anatomy of this disease. The structure of the pustules is that of those observed in human Variola; the thickened epidermis is not completely separated from the derma, but adheres in the centre, and around the circumference are numerous filaments, which appear to constitute a multiplicity of cells; to these the pustule owes its punctiform aspect.

In certain circumstances, the fluid in the pustules is so abundant as to flow over the adjacent parts; and generally in proportion as the discharge increases, the swelling and lameness observed at the commencement of the malady disappear. The character of this discharge has been already described, but it may once more be stated that its viscid consistency, fœtid ammoniacal odour, the bristle-like erect hairs, and the engorgement of the limb, give the disease, when it is located in the extremities, a very striking resemblance to "grease." At times this discharge is absent, and then there is only hot and painful swelling of the hind limb, terminating in an abscess containing matter which, by inoculation, produces Cow-pox.

DIAGNOSIS.

The diagnosis of this disease is very important, as there can be little doubt that in one or other of its forms it may, and has been, mistaken for Glanders or Farcy. As has been said, the eruption of the disease, when it appears at the lower extremity of the limbs, may be complicated with inflammation

of the lymphatic vessels and glands, and abscesses may form along the course of these, or in the subjacent cellular tissue of the skin on which the confluent pustules are located. These give the disease a certain analogy to Farcy, for which the Horse-pox may be mistaken if a careful examination is not made. Otherwise, between the pustule of Variola and the Farcy tumour, or "bud," the difference is so marked, that a mistake cannot be made if they are closely and carefully inspected. In Horse-pox, when the pustules have been confluent, there is always an ulcer remaining, with a sharply defined margin; this ulcer has a great tendency to cicatrization, and the pus which is thrown off from its surface is of a healthy character. This is not the case with the ulcer of Farcy.

When the eruption of Horse-pox is exclusively confined to the Schneiderian membrane, errors in diagnosis are yet more likely to occur. The identity of situation with that of acute Glanders, and the similarity of some of the symptoms common to the two maladies, renders mistakes easy: more especially as the great danger of infection from a glandered horse may cause the inspector to get through his examination as quickly as possible. Nothing so closely simulates acute Glanders as a confluent eruption of Horse-pox in the nasal cavities, accompanied by discharge, painful tumefaction of the submaxillary lymphatic glands, a flux of tears, dulness, general debility, &c. The resemblance becomes yet closer if the eruption appears at the same time on the lips, and the pustules there enlarge and ulcerate from external injury, giving rise to inflamed lymphatic vessels. The chances of error are then so great, that for a long time the benignant eruption of Horse-pox has been looked upon as one of the special features of the Glanders-and-Farcy condition. Dard, in 1840 (*Observations de Rhinite Pemphygoïde*), had called attention to the mistake; and Bouley soon after had occasion to notice it. The last-named authority has had many opportunities of satisfying himself as to the differential symptoms of the two maladies; though for many years, not recognizing the exact nature of Horse-pox, he designated it *herpes phlyctænodes*. "The primary element

of this eruption," he says, in a clinical lecture on the disease, "is a transparent pimple developed on an inflamed base, and resembling in shape a phlyctæna. This pimple, in its evolution, becomes lactescent through the change that takes place in the serosity it contains; then it is altogether purulent; finally, it bursts, and instead of leaving, as in Glanders, a rodent chancre, its presence is only marked by loss of epithelium on a circumscribed surface corresponding to the space it occupied. This constitutes a strongly-marked difference between the two diseases; when, indeed, we compare this apparently vesicular eruption with that of Glanders, we shall see how great are the differences between them. When the glanderous eruption is about to appear, the nasal membrane is of an uniform deep-saffron hue. In places there are red, circular, or elliptical patches about the size of a franc; at these the membrane swells and projects above the other portions of the membrane, constituting the *pustules*. At first salient, rounded at their summit, of a reddish-violet colour, which contrasts strongly with the bright-red areola encircling them, and hard to the touch, these pustules soon become white at the top; they then exhibit in their centre a very characteristic dull-leaden hue in the middle of the red circle surrounding them.

"At this period of its maturity, the pustule bursts, and discharges a sero-purulent fluid, which is tenacious, like the white of an egg, and forms a semi-transparent exudation on its surface. No sooner is it opened, than the pustule is replaced by a chancre exactly the same in dimensions; the borders of this chancre are of a deep-red colour, swollen, and prominent; at the bottom it is gray in hue and granular, with a semi-transparent serous matter covering it. This chancre rarely remains stationary in its dimensions; most frequently it extends with great rapidity, becomes deeper, and as it spreads transforms the pituitary surface into a large sore, the borders and centre of which offer the same aspect as the primary chancre.

"The pustular eruption of Glanders is sometimes discreet, though generally it is confluent; and when ulceration invades the agglomerated pustules, it converts them all into one vast chancre, which in a brief space invades the whole extent of

the membrane, in depth as well as in surface, not unfrequently involving and destroying the cartilaginous septum of the nose.

"The chancre of acute Glanders may sometimes cicatrize; but the mucous membrane is never regenerated at the spot it occupied, being replaced by a very dense white tissue, thicker than the membrane for which it is substituted, and it consequently stands above the surrounding level; the cicatrix is composed of fibres which radiate from the centre towards its circumference in a stellate fashion. The presence of this indelible cicatrix always betrays the loss of substance that has taken place in the membrane."

Such are the characters of acute Glanders, and it will be observed that the differences between them and those of Horse-pox are all the more marked as the eruption of each passes through its phases; forasmuch as, with time, the symptoms of acute Glanders increase in intensity, the nasal Horse-pox only requires a few days to run its course, disappear, and leave no trace of its existence behind. It is only at the initial period of both diseases, that there exists any particular resemblance between them. But when the variolous vesicles are isolated on the pituitary membrane, they can easily be distinguished from those of Glanders by their shape, volume, and aspect. When several vesicles, however, are grouped on a very limited surface, the concentration of the inflammation there causes the membrane to swell, and at a distance to appear as if covered with one large pustule, especially if there is an abundant discharge to prevent the eruption being readily distinguished. In such a case the diagnosis is more difficult. Even then, however, should a first examination not decide the question, it is only an affair of a few days' waiting, as when the eruption has reached a certain stage, there can then no longer be any doubt. If the pustule is the result of Glanders, it is soon replaced by a chancre whose character is unmistakable; if the eruption is that of Horse-pox, after the rupture of the agglomerated vesico-pustules which simulate a Glander pustule, there is nothing left but a simple denudation of the pituitary membrane, which, so far from assuming the cha-

racter of an ulcer, speedily vanishes beneath a new layer of epithelium.

With regard to the distinction between Horse-pox, when the eruption affects the lower parts of the limbs, and the non-specific "grease," or "stearrhœa," there can be no difficulty. The resemblance between the two is very superficial, and disappears when the surface of the skin is exposed by clipping away the hair, and freeing it from the viscid matter and crusts by soap and water. If the disease is Horse-pox, there will be observed either circular and cupuliform sores after removal of the epidermic crust from the pustules: these epidermic crusts being still attached, with the tuft of hair through them, though adhering but slightly; or, lastly, when the pustular sores have become pyogenic, the presence of some of the exuberant granulations projecting above the level of the skin.

These different characters may co-exist, or one may predominate over the others, according to the period at which the eruption is examined. At the commencement, all the pustules are covered by their epidermic crusts, which are more or less adherent; after this, these crusts, having become softened by steeping in the fluid discharged from the pustules, are nearly all detached and removed; at a later period, owing to the confluence of the eruption and the consequent abundant secretion, the cicatrization of the sores cannot take place as with the isolated pustules, so that each patch becomes a purulent wound, which heals only by second intention.

But whatever may be the conditions under which these pustules appear, or in whatever way their cicatrization may be effected, the character they give to the skin supporting them is so different from that observed in "grease," that none but the veriest tyro could mistake one for the other when a close and proper examination is made. Besides, Horse-pox, even when not interfered with, soon disappears, while "grease" often proves troublesome under various modes of treatment. Grease is neither contagious nor inoculable.

Should circumstances permit, and from five to eight days' delay be no objection, inoculation may be resorted to if there

still remain any doubts as to the nature of the disease. To avoid dangerous consequences, the matter from the pustules should be inoculated on the cow.

CONTAGIUM.

The contagium of Horse-pox is transmissible from one horse to another, to the bovine species, and to mankind,* but only by contact. That is, the virus is *fixed,* and the disease is communicated by *contagion :* not through the medium of the air, or *infection.* Such at least is the opinion of Bouley, who has made a careful study of the disease.† It is also produced by inoculation.

* In 1850, I witnessed a case of accidental transmission of Horse-pox (or "grease," as it was named) in Manchester, in a farrier, who shod an omnibus horse whose hind legs were in a very bad state, and the discharge from which covered his hands and apron. In a few days a large vesicle formed at the side of his mouth, where there had been a slight sore when he shod the horse; this vesicle presented the well-known characters of a vaccine vesicle, but in an exaggerated form. Its evolution was accompanied by rigors, sharp fever, and much prostration, and recovery was slow. From what I have seen, I believe that the transmission of the disease to farriers and grooms who have to do with cab, omnibus, and agricultural horses, is not so unfrequent as might be imagined; and, probably, if vaccination was not so thoroughly enforced, such instances would be far from unusual. Bouley, in his interesting article on the disease (*Nouveau Dictionnaire de Médecine*, &c., *Vétérinaires*, Art. "Horse-pox"), gives a striking instance of this transmission in a pupil at Alfort, who, in 1863, attended to a horse whose right hind leg was the seat of confluent Variola.

† Depaul believes the disease to be infectious, and cites, in support of his opinion, an instance in which a cow was inoculated with the fluid from the nostrils of a horse, and seventeen other cows inhabiting the same shed were soon after affected, Cow-pox pustules appearing on the udder and teats; in addition, a horse kept in a badly-constructed box in this stable, and breathing the same atmosphere as the cows, was also affected, the eruption showing itself on different parts of its body. It is not at all improbable, however, that the cow-keeper and his assistants, who handled the diseased and healthy animals alike, were the chief agents in diffusing the contagium. Indeed, the wife of the cow-keeper, in milking the cows, became vaccinated on one of her fingers, and yet continued to handle the teats of the others, notwithstanding the pain she experienced.

Bouley has caused perfectly healthy horses or cows to cohabit with

The fluid from the pustules contains the contagium in its most concentrated form, and it is all the more potent as it is clear and limpid. The crusts of the pustules are also potent in producing the disease by inoculation; by macerating them for twenty-four hours in glycerine, it is possible to obtain a fluid sufficiently active to produce well-developed pustules.

The saliva is likewise virulent, as has been frequently demonstrated experimentally. To induce the malady in a healthy horse, it is only necessary to rub the lining membrane of its mouth with the secretion from that of a diseased animal.

There is no proof that the disease can be communicated before the eruption has appeared, or even before it has commenced to secrete the variolous lymph. Neither is there evidence to show that it may be transmitted after the pustule sores have dried and cicatrized.

VITALITY OF THE VIRUS.

As yet no experiments have been undertaken to demonstrate the vitality of the infecting principle; but it is possible that, though lacking the extreme virulency of some other contagia, it may yet possess a tenacity which enables it to sustain somewhat severe physical and chemical tests. The epidermic crusts preserve their virulent properties, it would

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diseased horses, and when the malady was produced in them, he was always able to trace it to direct contact.

During the epizoöty observed at Alfort, in 1863, it was possible to transmit the Horse-pox to a series of horses, by placing them one after another in a stall which had been tenanted by a diseased horse. Each animal became affected in its turn, and at times their immediate neighbours also; but beyond these, in that stable there were no further transmissions, all the other horses dwelling therein remaining unaffected. As Bouley remarks, a really infectious disease does not comport itself in this manner. Turenne and Mathieu have also experimentally demonstrated that the malady is not infectious.

It is strange to find that equine Variola should only be contagious, while that of mankind, the sheep, and some other animal is most infectious, as well as contagious.

appear, for a long time ; and by macerating them in glycerine for twenty-four hours, a fluid may be obtained sufficiently active to produce well-developed pustules when inoculated.

MODE OF TRANSMISSION.

We have already mentioned that the disease is, in all probability, conveyed in a natural manner by immediate contact, *i.e.*, by the virus being applied in a tangible form, directly to the skin, either from the matter being placed immediately in contact with, or inserted beneath, that membrane, or conveyed to some mucous surface.

It may be transmitted by the litter of the stall in which a diseased horse has been kept. The forage which has been impregnated with the saliva from a sick horse can likewise contaminate the healthy. Indeed, the parts which are geneally most severely affected—the inferior extremity of the limbs, the nose, and lips—are those which are not only most likely to become contaminated, but those which will most readily contaminate.

As has been stated, the malady is readily transmitted from horse to horse by inoculation; of this there can be no doubt whatever, and the transmission is all the more certain as the lymph is clear and limpid. It is also transmissible to the cow, giving rise to Vaccinia, and to mankind. Transferred indirectly through the bovine species, its constitutional effects are apparently less developed than when inoculation has been made direct from the horse—the action of the equine virus being more energetic than the vaccine. The lymph of the so-called "spontaneous Horse-pox" also appears to be more active in producing its effects, than that which has been produced by inoculation.

MODE OF ACCESS.

The virulent principle of Horse-pox may obtain access to the system through the matter of the pustules coming into contact with the mucous membrane of the nose, mouth, or eyes, or meeting any raw or abraded surface on the limbs or other region of the body. In close, badly-kept stables, where

animals are crowded together and cleanliness is neglected, the malady may even be propagated at a distance.

INCUBATION.

We do not know the incubatory period of spontaneous, or rather accidental, Horse-pox. The incubation of the inoculated disease is from five to eight days. At the inoculated spot there usually appears, in from half an hour to three hours, a slight inflammation marked by redness and a trifling tumefaction, which lasts for ten or twelve hours and disappears, leaving only a minute cicatrix where the inoculation had been performed. In the majority of cases nothing else has been observed until the fifth, sixth, or eighth day, when the characteristic signs of successful inoculation begin to manifest themselves.

EXTENSION.

We have already said that Horse-pox sometimes appears in an epizoötic form, and though it may primarily appear in such a mysterious manner that its spontaneous origin has been accepted by several authorities as a fact, yet that contagion plays an important part in its diffusion. Nevertheless, the epizoöties of Horse-pox are not on a large scale; indeed, it appears to be almost the least liable to spread of all the contagious diseases that affect animals. Soiled forage, close proximity to the diseased, actual contact with the affected parts, instruments and stable implements, the conveyance of the virulent element by the hands of the groom, farrier, or dairymaid, lying on the same ground or in the same stall—all these and other modes may be in operation in extending the malady.

MORTALITY AND LOSS.

The damage occasioned by this disease is comparatively trifling, provided ordinary care is taken. The malady is generally not at all fatal.

IMMUNITY.

Though we have no positive facts, so far as I am aware, to

prove that one attack of the disease confers immunity from another; yet judging from what occurs with the Variola of other animals, there is every probability that the horse can only, as a rule, experience one invasion of the malady.

SANITARY MEASURES.

The benignity of Horse-pox, and its slight tendency to spread, almost precludes its admission into the category of such animal scourges as those already described. Nevertheless, in a work like this it is necessary to notice the disease, and somewhat in detail, if only to distinguish it from the dangerous and deadly malady for which it has been so often mistaken —Glanders, and its correlative—Farcy.

Isolation.

This measure is rendered necessary to prevent the extension of the malady. As this extension may also take place by giving healthy animals forage which has been soiled by the sick, dressing them with sponges or other articles which have become contaminated, &c., precautions can easily be adopted. As the disease can also be conveyed by the hands of persons who have been with the diseased animals, to cows and horses, as well as to themselves, care is necessary.

Cleanliness and proper hygiènic measures, particularly dry stables and good ventilation, are indicated.

CURATIVE MEASURES.

The medical treatment, in the great majority of cases, will be of the simplest kind. When the skin eruption appears without any complication, it may safely be allowed to follow its ordinary course: no intervention being necessary, except keeping the animals warm and comfortable, and away from draughts of cold air.

When the pustules become greatly inflamed, and there is inflammation of the lymphatic vessels and glands, the cause, which is nearly always local, must be removed; after which nothing more is generally necessary. Should the sores remaining

after rupture of the pustules assume an unhealthy character during very warm weather, they must be stimulated by cauterization.

The mouth eruption requires no other care than slightly acidulated gargles when the pustules open. The food should be, during the whole of this period, of easy mastication and deglutition.

The nasal eruption had better not be interfered with until the pustules have passed through all their phases—which generally requires three or four days.

COW-POX.

Synonyms. Technical: *Vaccinia.* French: *Picotte, Petite vérole des vaches, Variole des bêtes bovines, Vaccine, Cow-pox.* German: *Kuh-pocken.* Hindostani or Bengali: *Goru boshunto.*

GEOGRAPHICAL DISTRIBUTION.

This bovine Variola probably affects cattle in every quarter of the globe. According to Humboldt, cattle in Mexico are liable to it, and its power of protecting mankind from Small-pox has been known for a very long time. In Asia it is the same; and in India and Persia, the malady appears to manifest itself among bovine creatures in a very severe form at times. In Australia, cattle, and particularly newly-calved cows, have frequently an eruption more especially localized about the udder, which produces a similar eruption on the hands and arms of the people who milk them.* In Algeria, the lymph has been successfully utilized in vaccination.

CHARACTERS.

The Cow-pox consists essentially in a pustular exanthema occurring in the cow, and more particularly affecting the teats and udder; though in such hot countries as India, it may be

* From experiments it would appear, however, that this reputed Cow-pox is not capable of being transmitted to either human beings or other animals. See *The Australian Medical Journal* for 1872, p. 353.

more or less generally diffused over the body. It it usually accompanied by fever, and is communicable to other animals.

NATURE.

The same as other variolous diseases.

CAUSES.

The occasional causes of this disease are unknown. Animals kept in stables appear to be more liable to it than those which are at pasture; and it is more frequent in some years than others, spring being, of all the seasons, that which most favours its development. Circumstances which determine an increased afflux of blood to the mammary gland—as after calving—changes in food, great fatigue, &c., likewise appear to predispose to its advent. It only appears in the females of the bovine species, though the males are susceptible to it by inoculation.

Most frequently the disease appears in adult animals, though young and old are not exempt. It has been demonstrated that it may be developed by the transmission of the virus of Horse-pox through the medium of people who attend to these animals, as well as by association in stables and pastures. Nevertheless, it would appear to be a fact that the disease often enough manifests itself without the existence of Horse-pox being ascertained anywhere in the vicinity, and the highest veterinary authorities are consequently of opinion that it may be developed directly. Some are also of opinion that it is derived from the human species; but there is no proof of this. On the contrary, inoculation with the variolous matter of mankind will not produce Vaccinia, and if people are re-inoculated from the pustule produced at the point of inoculation, they will have Small-pox.

SYMPTOMS.

The description of these, because of the little importance which attaches to the disease, will be brief.

After slight febrile disturbance, partial loss of appetite, and suspension of rumination, trifling constipation and diminution of the urinary secretion—symptoms which may, nevertheless, be absent or unperceived—and lessened quantity, as well as

altered quality, of the milk (more watery and disposed to coagulate than usual), the udder is observed to be swollen, particularly near the teats, and is painful during milking. Some days afterwards there are seen on the udder, and chiefly on the teats, small hard tumours, varying in size from a pea to that of a haricot bean, and of a pale-red colour. Increasing in volume, beneath the epidermis, there forms a viscid yellow fluid; at first this appears in the centre, but it extends towards the circumference, giving the nodosities a light blue tint in the middle, but a reddish-blue or yellow colour towards the periphery; at this period the centre is also usually umbilicated or depressed, the border is hard, swollen, and painful, and when the skin is thin and transparent a red areola is noticed. These "pocks" gradually increase in dimensions, and towards the eighth or tenth day have acquired their maximum development; on the udder they are generally circular, and on the teats oblong. The contents then become purulent, and a crust begins to form in the centre, extending to the margin; this crust is thick, shining, and deep brown or black in colour; it is firmly attached to the skin, from which it does not become detached until the tenth to the fifteenth day, unless accidentally removed. When it has fallen off it leaves a cicatrix in the skin, which persists for a considerable period, and is at first bluish-red in colour, but gradually becomes pale. On the udder the cicatrix is depressed in the centre.

In the same animal there may be successive crops of pustules, or they may not be all developed simultaneously, some being crusted, while others are only nodes. This later eruption may, however, be due to re-inoculation during milking, and this is favoured by the existence of sores or cracks on the teats. In consequence of this circumstance, the malady may not pass through all its phases within a less period than four to six weeks. It is usually towards the eighth or ninth day of the development of the pustule, that the vaccine matter is collected.

As Röll remarks, the variable colour of the vaccinal pustules is not an essential characteristic of the disease, and

therefore does not certainly demonstrate the real nature of the variolous eruption. If the skin is fine and white, the variolæ have a silvery, bluish-white, or slaty hue; if it is fine but dark-coloured, they are leaden-gray; if the hair is of a bright shade, they have a colour varying from a bright-red to a pale-red or blood-red, but have always a metallic lustre; on a thick, white, and wrinkled skin, they have a dull opaline aspect. If, therefore, the diagnosis is doubtful in this respect, it can only be rendered positive by studying the progress of the disease and the structure of the pustule; as well as by ascertaining the results yielded by inoculation.

COURSE AND TERMINATIONS.

The course and termination of the disease is generally favourable—at least in western countries (it is in these that the foregoing symptoms have been noticed). It is always benignant, and the only inconveniences it produces are those resulting from the fever, loss of appetite, and the local inflammation, as well as the loss arising from the bad quality of the milk when it continues to be secreted. The ulcerations of an unhealthy character which sometimes appear on the teats, as a consequence of Variola, depend upon the health of the animal, improper treatment, or bad hygiène and uncleanliness. Abscesses in the gland may result from the same cause. The ordinary duration of the disease is from fifteen to twenty days.

FALSE VACCINIA OR VARIOLA.

Under this designation, as well as that of *Vaccinella* and *Vaccinoïdes*, is described a disease, or several forms of disease, similar to the preceding, but yet differing in important features. It is remarked most frequently soon after calving, and attacks nearly all the cattle in the same shed after it has appeared in one. It is very uncertain in its transmission to mankind. The symptoms are much like those of the Cow-pox, the only essential differences between the two maladies being limited to the eruption, and the lesser degree of virulency of the infecting agent in the first.

The eruptions of false Vaccinia may be divided into three groups. One group consists of acuminated variolæ. These may or may not be developed at the same time as the true variolæ, and appear as small red nodes about the size of a grain of millet, destitute of areola and umbilicus, and soon changing into a pointed pustule, whose purulent contents quickly dry up, and are promptly succeeded by a crust: the whole process only requiring from four to six days. The eruption may re-appear several times, however; so that the entire period may extend over a number of weeks.

Papular or hard variolæ (*Stein-pocken*), are another variety, and vary in size from that of a pea to a nut. They are hard, indolent tumours, moderately red at first, and have no areola; or they appear as warty excrescences on the skin of the udder. They frequently remain unaltered for weeks, or even months, and at last disappear very slowly.

The third group consists of watery and emphysematous variolæ; these appear on the udder in the form of red spots, which are rapidly transformed into vesicles from the size of a pea to that of a cherry, but destitute of areola and umbilicus. They contain a serous or purulent fluid, are readily broken, and are covered by very thin crusts, which soon fall off. Frequently their contents are quickly absorbed, leaving only an empty epidermic envelope, which constitutes the emphysematous Variola. They pass through all their phases within five to six days.

DIAGNOSIS OF TRUE VACCINIA.

The diagnosis of this disease is easy, if what we have already stated be remembered. In Aphthous fever, a vesicular eruption not unfrequently appears on the udder, but this differs so widely from the Vaccine vesicle, and its other accompanying symptoms are so dissimilar, that a mistake should not occur.

CONTAGIUM.

The virus of this disease is fixed, and is only conveyed through actual contact of the animals, or its transmission by

the hands of the milkers. Chauveau has demonstrated that Vaccinia can be as certainly produced through the digestive organs, as by the injection of the virus into the blood-vessels. The disease is so mild in its character, and as a rule, so rare, that it does not demand any further notice in this respect, until we come to speak of the sanitary policy to be adopted towards the remaining variolous diseases.

SANITARY MEASURES.

These may be of the simplest kind. As the virus does not appear to be volatile, it is only necessary to prevent actual contact; and in the majority of cases it will be sufficient to milk the affected animals last. The milk should not be consumed.

CURATIVE MEASURES.

These, in nearly all cases, will be limited to cleanliness, to care in milking (which should always be done to prevent accidents), and to appropriate treatment of any secondary local results of the disease.

GOAT-POX (*Variolæ Caprinæ*).

This disease is very rare, and the eruption, which bears the closest resemblance to that of the cow, though the pustules are smaller, only appears on the udder and teats, but chiefly the former. It may be directly developed, or through infection from sheep affected with Variola. It is communicable from one goat to another. It is a benignant disease.

The sanitary and curative measures are those applicable to Vaccinia.

PORCINE VARIOLA (*Variolæ Suillæ*).

CHARACTERS.

This disease is more frequent than the last, and appears on the head, neck, chest, and belly, as well as the inner aspect

of the thighs. Although directly developed, according to the best authorities, its extension by the transmission of its contagium appears to be the most frequent cause. It seems to be an established fact that the Variola of the pig may be communicated to mankind and to the goat, as that of man has been communicated to the pig.

The disease most frequently affects young pigs, and one attack confers permanent immunity. The contagium is fixed and volatile.

SYMPTOMS.

The symptoms are pretty constant in their development, and in their course are not unlike those of Sheep-pox. After the febrile phenomena, which are often very intense, and continue for some days, there appear on the parts of the body already indicated red spots, which are soon transformed into nodules. Towards the sixth day of the disease these become vesicles, and about the ninth or tenth day pustules; the contents then begin to desiccate, and form a crust which is eliminated in a few days, leaving a well-defined cicatrix.

In the pig, the malady follows a similar course, and has similar terminations, to those of ovine Variola; the eruption appearing as discrete and confluent, and the disease being designated as benignant or malignant, regular or irregular, according to the form it assumes.

In its general character, contagiousness, symptoms, course, and terminations, the Variola of the pig bears more analogy to human Variola than that of any other of the domesticated animals. It is sometimes very fatal.

SANITARY MEASURES.

As the malady is highly contagious, every care should be taken to separate the diseased from the healthy, and to prevent the transmission of the contagium. Disinfection and cleanliness, with plenty of fresh air and dry bedding, must be strictly enjoined.

CURATIVE MEASURES.

Food easily digested, and bland gruel, must be given in small quantities and often. Sometimes an emetic administered at the commencement is beneficial. At a later period acidulated gruel, and mild saline laxatives, are useful. In the more severe form of the disease, stimulants and nourishing food should be given.

USE OF THE FLESH OF VARIOLOUS PIGS AS FOOD.

As the malady is communicable to the human species, the flesh of diseased animals should not be utilized as food; the carcasses must therefore be buried.

VARIOLA OF THE DOG (*Variolæ Caninæ*).

CHARACTERS.

This is a rare malady, and may be developed directly or by contagion; it is supposed to be also produced by the Variola of man and of the sheep. It chiefly affects young dogs, although old animals are not exempt. One attack ensures immunity for the remainder of the dog's life.

SYMPTOMS.

The disease commences with fever, which continues for two or three days, and is followed by the appearance, over a large surface of the body, though rarely on the back and sides of the trunk, of red points resembling flea-bites, which are quickly transformed into nodules and then into vesicles. The contents of these become purulent, and finally dry into a crust, whose shedding leaves a naked cicatrix.

In the dog, as in the sheep and pig, there are different forms of the disease, and it is benignant or malignant accordingly. Puppies nearly always succumb, and on a necroscopical examination it is not unusual to find variolous pustules on the mucous membrane of the respiratory and digestive organs.

SANITARY MEASURES.

The disease being contagious, though the virus does not appear to be very volatile, it is necessary to isolate the sick, and take due precautions that the contagium is not carried from them to healthy animals.

CURATIVE MEASURES.

Careful dieting, a dry and moderately warm dwelling, cleanliness, and abundance of fresh air, are the essentials in curative treatment.

An emetic in the early stage of the malady has been recommended as likely to be useful. Afterwards the treatment must be purely symptomatic.

VARIOLA OF FOWLS.

Birds have their peculiar form of Variola. That of domesticated fowls has somewhat similar symptoms to the disease in mammals. The bird is feverish and dull; the feathers stand erect; the wings and tail are more or less pendent, and the pustules appear chiefly on the head, neck, and inner surface of the wings and thighs. In the turkey, they appear as little yellow vesicles, surrounded by a red areola. In from twelve to fifteen days after their appearance they become encrusted; the fever then disappears, and health gradually returns.

In geese, the pustules on the neck not unfrequently increase in size and form abscesses; the feathers fall off, pieces of skin may even become detached, and the resulting lesions are so serious that death is not an unusual termination.

The disease is believed to be contagious, and it is therefore necessary that isolation of the sick, and other precautions to prevent the spread of the contagion, be adopted.

ANTHRAX AND ANTHRACOID DISEASES.

UNDER the designation of "anthrax," the older writers on medicine included a group of virulent and contagious diseases, which, although identical with regard to the fundamental and characteristic alterations accompanying their evolution, are yet distinguished by different symptoms, not only according to the species of animal affected, but also by the epizoötic, enzoötic, and sporadic influences which give rise to these changes. In the attempt to define these different diseases, or rather the different forms of the one disease, we will follow, as nearly as may be convenient, the arrangement adopted by Reynal, Röll, Haubner, and others, space forbidding our adopting the exhaustive plan carried out by Heusinger in his classical treatise.*

SYNONYMS.—The various names given to Anthrax and its different forms are extremely numerous; indeed, far too numerous for mention in this place, differing as they do, not only according to the country, county, district, or village in which they occur, but also according to the particular appearance, physical characteristic, malignity or location of the malady, or the opinion entertained as to its nature or cause. We will, therefore, only give the principal designations, and especially those of historical, geographical, or pathological importance, merely remarking that Anthrax, as a generic term, is preferable to any yet proposed.—Greek: ἄνθραξ. Latin: *Sacer ignis. Anthrax. Anthrax epizoöticus. Glossanthrax. Pustula maligna. Apoplexia splenitis. Erysipelas carbunculosum, Carbunculo contagioso, &c.* English: *Inflammatory fever. Anthrax fever. Carbuncular fever. Black quarter. Quarter ill or evil. Joint-ill. Black-leg. Black spauld. Higham striking. Speed. Hasty. Puck. Shoot of blood. Splenic apoplexy. Blood-striking. Pining. Braxy. Blain. Tongue evil. Gargis. Hawks. Hog-cholera. Distemper in pigs. Red soldier. Blue sickness. Blue disease. Measles.* French: *Fièvre putride, pestilentielle, pernicieuse, ataxique, adynamique, adennerveuse, maligne,* or *flogoso-gangréneuse. Peste rouge* or *charbonneuse. Typhus* or *fièvre charbonneux. Charbon*

* Die Milzbrand Krankheiten der Thiere und des Menschen. Erlangen, 1850.

interne. Splénite gangreneuse. Typhohémie. Pélohémie. Congestion sanguine. Maladie de sang. Sang de rate. Mal de montagne. Charbon externe, essentiel, or *symptomatique. Anthrax rubens. Gloss-anthrax. Mal le langue. Charbon à la langue. D'avant-cœur. Anti-cœur. Louvet. Puce maligne. Maladie rouge. Soie. Quartier. Trousse-galant. Araignée. Noir-cuisse.* German: *Anthrax. Blut-krankeit. Blutschlag. Blutseuche. Feuer. Beulenseuche. Brandbeu-lenseuche. Miltzseuche. Miltzbrand. Milzbrandfieber. Fliegendenbrandes. Karbunkelkrankheit. Zungenkrebs. Fliegenderkrebs. Schwarze-blatter. Blaue-blatter. Rothes. Rothlauf. Der typhus. Typhöse krankheiten. Fleckentyphus. Petechialtyphus. Brandiges. Bräune. Hexenschuss. Teufelschuss. Erdsturz. Gelber schelm. Gelbes wasser. Knotenkrank-heiten. Rückenblut. Rankkorn. Wildes blut. Sommerseuche. Sumpf-fieber. Pestfieber, &c.* Italian: *Carbone. Antrace. Febbre carbonculare. Febbre carbonchiosa. Carbonchio. Vespajo. Milzone-cedrone. Fuoco S. Antonio. Cedron. Febbre contagiosa antracica carbonchiosa. Mal sanguig-no. Mal volante. Mal rosso. Malbrussarola.* Spanish: *Lobado. Ranilla. Alevosa. Carbunculo. Basquilla.* Dutch: *Miltvuur. Typheuse varken-ziekte. Fenyn.* Swedish: *Furia infernalis* (Linnæus). *Boskapssjukan. Troll-skott* (witch-shot). *Skottsjukan* (shot-disease). Lappish: *Skott. Miltsyge.* Finnish: *Boskapspest. Boskapsfarost.* Esthonian: *Wil. Sinni-wil. Wessi-wil. Willi többi.* Russian: *Jaswa, Morowaja jaswa* (ulcer or ulcer-plague). *Schelwaki* or *Sibirskaja jaswa* (boil, Siberian boil). *Wetrenizza* or *Powetrie* (Plague). *Wosduschnaja bolesu* (wind or air-plague). *Jaschtschur.* Tartar: *Naguptan.* Khirgish: *Mohmo.* Hungarian: *Tsoemoer. Pokolvar.* Moldavian and Walla-chian: *Dalack. Kricciam.* Peruvian: *Grano de peste.* Paraguayan: *La Mancha.* Brazilian: *Carrapato.* Mexican: *Calentura del piojo.* North American: *Trembles.* Dry Murrain. Bloody Murrain. Splenic Fever. Spanish Fever. Cattle Fever. Texas Fever.* New South Wales (Australia): *Cumberland Disease. Black-leg.* Bengalee: *Bikar. Sonni-pat. Pilei. Rossiner pirdaho.*

* This designation, as well as that of "milk sickness," has been given to a peculiar enzoötic disease of cattle observed in the United States of America. It is not of the nature of Anthrax, but is due to vegetable poisoning; the plant being, according to some authorities, a species of rhododendron which grows on low woodland pastures. Its toxological properties are somewhat extraordinary, and are analogous to those of the fungus which some northern people consume in order to produce intoxication. The flesh and milk of the cattle affected with "trembles" will communicate the disease to other animals when consumed as food, and the flesh or milk of these will again transmit the malady to others, and so on. People have frequently suffered from it, through eating the flesh or drinking the milk.

GEOGRAPHICAL DISTRIBUTION.

This is one of the most diffused and interesting of all the diseases of the lower animals, affecting, as it does, not only those which are in a state of domestication, but destroying those which are untamed and living in a savage condition. It prevails, in one or more of its diversified forms, over the entire surface of the globe,—in high latitudes, as well as under the equator. It at times decimates the reindeer herds in Lapland and the Polar regions, and is only too well known in the tropics and in temperate latitudes by its dangerous, and nearly always disastrous, consequences. The carefully-tended ruminants of the most highly civilized countries suffer equally with the wandering herds and flocks of the Khirgese and Mongol Steppes; and it is as much dreaded by the Finn and the Lapp as it is by the Mexican, the Arab, the Annamite, or the South African and Australian colonist. It has been carefully described by travellers and others, as they have observed it affecting animals in Siberia, Lapland, Finland, Egypt, the East and West Indies, Russia, Central Asia, China, Cochin China, Peru, Paraguay, Brazil, Mexico, North and South America, Australia, and different parts of the African continent; while for European countries, the writings which have been published with regard to its nature, its peculiar characteristics, and the damage it inflicts, are innumerable. Countries in which are extensive marshes, or whose subsoil is tenacious, are usually those most frequently and seriously visited. Thus it happens that there are regions notorious for the prevalence of Anthracoid affections: such as the marshes of Sologne, Dombes, and Bresse, and certain parts of Germany, Hungary, and Poland; in Spain, the disease is enzoötic in the semi-submerged valleys and the maritime coasts of Catalonia, as well as in the Romagna and other marshy districts of Italy; while it is epizoötic, and even panzoötic, in the swampy regions of Esthonia, Livonia, Courland, and especially of Siberia, where sometimes, in order to suppress the ravages of the terrible "jaswa," the aid of the military authorities has to be invoked,

and battalions of soldiers sent to bury or burn the carcasses of infected animals which float in the canals and swamps. We do not know of a region in the whole world where it is unknown, and its antiquity is as great as its extension is wide. It was one of the scourges with which the Egyptians were punished through the instrumentality of Moses, when there was "a breaking forth with *blains* upon man, and upon beast, throughout all the land of Egypt;" "upon the horses, upon the asses, upon the camels, upon the oxen, and upon the sheep." The most ancient writers have alluded to it, as if it were the only disease worth describing; and Virgil has eloquently depicted its deadliness and contagiousness with the greatest accuracy. It figures largely in the histories of the Early and Middle Ages as a devastating pestilence among animals, and through them to mankind; and our own oldest Anglo-Saxon manuscripts contain many fantastic recipes, leechdoms, charms, and incantations for the prevention or cure of the "blacan blegene" (black blain) and the "elf-shot" creatures. From these up to our own times, it has attracted more and more attention; even in this century manifesting itself in some of its outbreaks over the whole of Europe, from Siberia to France; and in those countries in which veterinary science has been carefully cultivated, it has been a prolific source of study and research, not only from the many interesting problems which have to be solved by the comparative pathologist with regard to it, but also from its important relations to agriculture and the health of mankind.

CHARACTERS.

This is the most universal disease we are cognizant of as affecting animals, attacking, as it does, even birds and fishes. All the domesticated, as well as the undomesticated, animals suffer from its effects; though it appears that certain among them have a predisposition to its direct, primary, or spontaneous development: these are the herbivorous mammals—particularly solipeds and ruminants. In carnivorous and omnivorous animals, with the exception of the pig, this mode of pro-

duction has not been fully established ; yet it is transmissible to these and to mankind, by inoculation and in other ways.

It is most frequently observed in bovine animals, pigs, and sheep ; less frequently in the horse and ass species, and in poultry. At times it causes great destruction among wild creatures. It is a constitutional disease, appearing in all climates—polar, temperate, and tropical—and in all seasons, but principally during and after hot weather; manifesting itself as an enzoötic or epizoötic, but rarely as a sporadic, malady. It is contagious—eminently so according to some authorities ; but this characteristic appears to be modified by climate, and by the species of animal in which the affection is developed; and it might be considered rather a miasmatic than a virulent disease.

Anthrax owes its name to the formation of a particular kind of pustule, malignant in its nature, and dark or carbuncle-coloured. If, however, the disease occurs spontaneously in the horse, ox, sheep, pig, or other animal so predisposed, and especially if it is very precipitate in its course, a pustule or Anthrax is not observed in the majority of cases. In other instances, the pustule is developed soon after the commencement of the disease ; and after inoculation the malady nearly always first manifests itself by the formation of an Anthrax. This evolution of a contagium in a general malady, and its propagation from an infected part, is curious and interesting.

Whether or not it be accompanied by this local manifestion, Anthrax is characterized by certain distinctive peculiarities, of which the principal are: an acute and sometimes extremely precipitate course, a tendency to exudations and the extravasation of dark blood, the frequency of gangrenous processes and serious consequences, the constant presence of suddenly developed tumours in the spleen, and special alterations in the composition and aspect of the blood. That fluid accumulates in the large veins, particularly in those of the abdomen ; it is viscid, very dark-coloured, and never yields more than a feeble clot. In those cases which terminate fatally, it contains peculiar, club-shaped, microscopical bodies (*bacteria*) in immense numbers, more particularly in certain animals ; indeed, the malady is characterized by the presence of these cryptogams, which

are readily transmissible to other creatures of the same or different species, and produces in them a similar condition.

NATURE.

Notwithstanding the numerous investigations that have been undertaken to discover the nature of this world-wide disease, and the many hypotheses that have been promulgated, we have not yet been furnished with a completely satisfactory solution of the problem. The general symptoms are certainly due to a primary decomposition or alteration, *sui generis*, of the blood; but the discussion as to the nature of this alteration is still pending. The most recent researches would tend to prove that it is of miasmatic origin, and consists essentially in a primary and special alteration in the elements of the blood, due to the presence of minute organisms, apparently of vegetable origin, which act somewhat in the manner of a ferment, by depriving the blood of its most essential element. This hypothesis, however, is not generally accepted; and we might, in the present state of our knowledge, say that it is an acute blood disorder, or disease, of a septic nature, constituting a dyscrasy, and that it is typical of those conditions or maladies characterized by the presence of particular symptoms and a septicæmic virus.* The products of the morbid pro-

* The condition of the blood in what has been designated "septicæmia," is observed in other affections than Anthrax; being often developed during the progress of diphtheritic inflammations; suppurative processes, or those which lead to the production of sanious accumulations; Glanders; the retention of urea in, or the introduction of certain animal poisons into, the blood; or from excessive muscular exhaustion, as in the case of severely-hunted or over-travelled animals.

The blood is in a peculiar state of decomposition, and scarcely, if at all, coagulates. It is a tarry-looking, sticky fluid if it sets; has a dirty, dark-brown hue; the serum is red, and rapidly putrefies; and it gives a disagreeable colour to the tissues which imbibe it, as well as to the different secretions and excretions.

This alteration is accompanied, in the living creature, by very intense fever and considerable obtuseness of the senses; the pulse is quick, small, and weak; the visible mucous membranes have a dirty-yellow appearance, and are frequently ecchymosed; sanguineous diarrhœa and dyspnœa are not uncommon; and the animal sinks more or less rapidly, according to

cesses are deposited in different parts of the body, and thus give rise to the different forms of the disease. From the influence of locality in its production, and certain phenomena preceeding or accompanying its advent, it might be looked upon as a miasmatic or malarious affection.

CAUSES.

The predisposing or exciting causes assigned as operating in the production of Anthrax in its different forms, are multifarious and somewhat perplexing to the etiologist: so diverse, uncertain, and opposite do they appear. But it is extremely probable that the primary development of the disease demands a combination or concurrence of circumstances still imperfectly, if at all, known, but obviously dependent on local conditions. These circumstances, and particularly if their action is prolonged, insensibly modify the constitution of animals exposed to them, and to such a degree as to produce the Anthrax dyscrasy, in which the slightest occasional cause may determine the evolution of the malady.

As a general rule, it may be stated that the predisposition to the development of Anthrax is neither modified by age nor sex; though it has been remarked that pregnant and comparatively young animals are most frequently attacked. When the disease appears in an enzoötic or epizoötic form, it usually at first seizes the most vigorous and well-nourished, especially if it is of a very acute type; while if it is less acute, it also attacks those which are in poor condition. Animals recently introduced into a country in which Anthrax prevails enzoötically, succumb more frequently and rapidly than those already acclimatized.

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circumstances. On examination after death, in addition to the alterations just mentioned, there are most frequently found tumours in the spleen, with enlargement and red coloration of the mesenteric glands. In some cases, the blood has an acid reaction; in others, it contains carbonate or hydrosulphate of ammonia; the blood-globules are partially destroyed, and no longer possess the power of assuming a red colour on contact with the air. In Anthrax, as we will see hereafter, there are other alterations of an important character.

It is most frequent and fatal in regions where the soil contains much organic matter in process of decomposition, and in those in which, while rich in humus, the land is retentive of moisture ; in boggy countries, and marshy or swampy districts ; and in localities liable to frequent submersion, or in which the surface water cannot escape or is in process of slow evaporation. The injurious influence of these conditions is increased if the soil contains saline matters, such as sulphates, which favour the decomposition of organic substances. Röll, from this circumstance, seeks to explain the more frequent appearance of Anthrax in places where the ground is manured with the aid of mineral matters, as marl, lime, and chalk.

In such countries Anthrax is really enzoötic, and they may be justly designated "Anthrax districts" (the Germans designate such a region a "Milzbrand-Districte").

In France, there are districts notorious for the prevalence and the havoc caused by the malady; among these may be mentioned Beauce, Chartres, Brie, Champagne, Berry, Poitou, Auvergne, Dauphiny, and Bourgogne. It is the same in Germany, Russia, Italy, Spain, Norway, Sweden, and other countries.

It is organic substances undergoing decomposition under the influence of the humidity of the atmosphere, which furnish the miasma supposed to be the cause of Anthrax. A high temperature, in favouring the evaporation of moisture from undrained land rich in vegetable matter, or from marshes and swamps, and thus exposing a large quantity of organic material, still further accelerates its decomposition ; and the products accumulate in the surface soil, the air which the animals breathe, and the water they drink, as well as, perhaps, in the food they eat.

It would, therefore, appear that Anthrax is always due, when it arises spontaneously, if we may employ the term, to miasmatic infection ; and if we are to accept the opinions of recent investigators, this infection is cryptogamic in its nature, and is suspended in the air surrounding the animals, or it is contained in the aqueous vapour which they breathe, in the water they drink, or the food they consume. This agent,

obtaining access to the blood, acts upon it as a septic ferment. The miasmatic infection may extend beyond the region in which it is developed, when certain atmospherical conditions are favourable, such as the prevalence of certain winds, which carry these vegetable germs to considerable distances; and if the temperature and other circumstances are not unfavourable, they retain their vitality and powers of multiplication.

This explains, to some extent, the severe and extensive outbreaks of Anthrax at certain seasons, and in certain districts where, at other times, it may be somewhat rare; and likewise why a sudden transition to cold weather may check their progress, or suddenly suppress them.

Numerous facts testify to the correctness of this view. In former ages, when the land was badly cultivated, and drainage was unknown or unpractised, Anthrax in its various forms was far more common and severe than it now is, where improved methods of agriculture, and the removal of an excess of moisture from the soil, have been introduced.

Great Britain was for many centuries, and even up to a recent date, greatly scourged by some of the most malignant and devastating of these forms, which were fatal, not only to the domesticated and feral creatures, but caused a large mortality among the people; now these have nearly disappeared (especially Glossanthrax), or are only witnessed in remote districts which retain their primitive condition and insalubrity.* Perhaps the most common form, that which is known as "black quarter," was formerly quite common in localities where it is now never seen, and this disappearance would appear to be coincident with the introduction of drainage. The malady is still frequent, however, on retentive, undrained clays. The same circumstance has been observed in other countries. Those most backward in agriculture suffer most extensively and fatally: as certain parts of Russia, and tropical countries in general.

* For an historical description of the most serious and interesting of the epizoöties of Anthrax in this and other countries, from B.C. 1490 to A.D. 1800, *see* "Animal] Plagues." Those which occurred in England in the early centuries, particularly the thirteenth, are well worthy of notice.

Wald states that in several localities of the district of Potsdam, where the disease used to be frequent, it is now rare, since the dangerous pastures have been converted into arable land, and the animals are fed in stables. Buhl also reports that the disease prevailed for more than a year at the breeding establishment of Neuhof, near Donanwörth, but completely disappeared after the advice of Pettenkofer had been followed, and the water was considerably lowered. On the other hand, it has been conclusively proved that in certain countries where abundant manuring, and particularly with mineral matters, has been resorted to, and the decomposition of organic substances in the soil thereby hastened, Anthrax, before unknown, has appeared. Reynal, for instance, speaking of the malady as it manifests itself in France, says that there are regions where, in certain farms, it is not possible to park the sheep without their being immediately attacked with splenic Apoplexy ; that when the ground is abundantly manured and treated with marl, or when extensive improvements are made, the soil turned up, the land cleared of wood, &c., the ravages of Anthrax become most extensive. He also remarks that splenic Apoplexy, after prevailing in a malignant form for a certain time in a locality, becomes comparatively benignant ; that it invades neighbouring localities hitherto privileged ; and that it is by virtue of this general law that it is now much less frequent in Beauce, while it has invaded the adjoining communes of Perche. It likewise appears from his statement that it usually appears in France in elevated localities destitute of trees, with a calcareous or argilo-calcareous subsoil, and which, owing to the old-fashioned and defective triennial *assolement*, are almost exclusively given up to the cultivation of cereals and artificial pasture, and to maintaining numerous flocks, which are either permanently housed, or live out in the open air during the day and night in the hot summer. It also haunts localities placed in exactly opposite conditions—on clay or argilo-silicious soils, low, damp, wooded, and broken, with natural pastures, and having only few and small flocks, which pass their days grazing in the open, and their nights in the sheep-fold, except in snowy or rainy weather, when they are alto-

gether sheltered. Such localities are to be found in Perche, Normandy, Brittany, Maine, &c.

From the remarks which have been already made, there will be no difficulty in understanding why the disease should suddenly appear, though perhaps only for a short time, in consequence of exceptional circumstances: such as an inundation, and particularly during hot weather.

Meteorological influences would appear to favour the development of the disease, and facilitate its propagation. A very hot, stifling atmosphere; a high temperature, especially if it be unseasonable; the air charged with electricity, this being accompanied by frequent actual or threatened storms; sudden changes of temperature, as burning hot days and cold nights—though cold weather is generally unfavourable for the evolution of the disease. It is in consequence of the presence of these different conditions, that Anthracoid affections so frequently appear in a general form in the confined valleys of mountainous countries, when the nature of the soil is favourable to their production, and the high temperature of the day is suddenly succeeded by a chilly night. The same might be said for the production of the disease in hot, overcrowded, and filthy stables.

The nature and quality of the food has also been blamed as aiding in the production of Anthrax. Pasturing on rich herbage, such as clover, especially if allowed to consume it in large quantity and suddenly, after being insufficiently fed, or on that which is indigestible; grazing on low marshy pastures, or on those which, though they may be elevated, only yield a dried-up, innutritious, and not easily digested food, have been mentioned. Forage which is mouldy or damaged, has likewise been accused of developing the disease.

Water of a brackish, marshy, or putrid character, and charged with organic matter, has been credited with a large share in the genesis of Anthracoid affections, and perhaps not without reason; though it must be remembered, if this water is ingested in marshes, that the animals are also exposed to the malarious emanations, and these may be wholly or in part the cause.

The insalubrity of dwellings and inattention to hygiène, and

especially overcrowding and bad food, have been stated to act powerfully in developing the malady in pigs.

When once developed, the disease may be largely extended by contagion, according to circumstances.

The immediate or real cause of the symptoms of Anthrax, whatever it may be, would appear to act on the blood, according to Virchow's theory, as a septic ferment, producing, after a certain time, such alterations in that fluid as bring about the local disturbance and subsequent effects that characterize the disease. Brauell, Pollender, Davaine, Chauveau, and others have drawn attention to the presence in the blood of animals affected with Septicæmia, both before and after death, of myriads of staff-shaped bodies which have been designated *vibriones* and *bacteria* or *bacteridia;* and several of these authorities, especially Davaine, contend that the toxical effects of such blood may be chiefly, if not exclusively, attributed to these very minute organisms. Others, again, like Onimus, think they are the product, not the cause, of Septicæmia, and that the peculiar properties of such blood cannot be ascribed to them. As the question may be said to be still pending, we cannot enter upon the arguments, nor allude to the experiments resorted to by both sides.* It will therefore be sufficient to mention that,

* A notice of a critical analysis on the nature of Septicæmia, which appeared in the *Moniteur Scientific Queensville* for October, appeared in the *London Medical Record* for November 19, 1873. This contains a sufficiently detailed account of the discussion as it at present stands. We need only indicate the conclusions arrived at by Papillon, who endeavours to harmonize the facts already ascertained, and which by some might be thought to point to opposite results.

After giving a brief account of some interesting experiments recently made by Chauveau (published in the *Recueil de Méd. Vétérinaire* for 1873), in which putrid liquids were injected into rams whose spermatic cord was subcutaneously ruptured or cut, Papillon points out that the first undeniable fact, due to Pasteur, is that putrefaction, or septic metamorphosis, fatal in ordinary air, is impossible where air is excluded, or where it is chemically pure; which seems to warrant the conclusion that the primary cause can only be something which exists in ordinary air, and does not exist in pure air: that is to say, an organized duct. The second undeniable fact, which we owe to Davaine, is that septicæmic virulence is transmissible by inoculation, and increases to a certain limit, in the process of successive inoculations from animal to animal. It still exists when one can no

with regard to the relation of bacteria to the virulence of sep-

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longer distinguish bacteria in the dilution of virulent liquid. The third ascertained fact, furnished by Onimus, is that mineralized water, charged with bacteria which have arisen in it, has no toxical action comparable to that of septicæmic blood. The fourth undeniable fact, yielded by Chauveau's experiments, is that the introduction of a liquid charged with bacteria into an organ, the interior of which is isolated from the rest of the system, produces in this organ (air being excluded), phenomena of putrefaction, while the introduction of the same liquid, absolutely free from bacteria, produces no such result. These are the four facts to be reconciled, and this reconciliation, according to Papillon, is easy. It consists simply in rejecting the two opposed and irreconcilable conclusions which have been drawn from the facts, and adopting the only one remaining. The conclusion of Onimus, that bacteria are not the cause, but the product, of putrefaction, cannot stand before the facts of Pasteur, who shows that contact of aërial germs is indispensable to produce this condition. The conclusion of Davaine, Pasteur, and Chauveau, that bacteria have necessarily a toxical action, cannot stand before the facts of Onimus, Leplat, Saillard, and others, who prove quite the contrary. The remaining conclusion to which we are led, is that the true agents of putrefaction and Septicæmia are not adult bacteria, visible and measurable by the microscope—perfect organisms, so to speak—but rather the germs of bacteria monads, absolutely inaccessible to all our means of direct observation. These germs can act with insidiousness, because they can penetrate into the innermost parts of the tissues. They become, for a time, an integral part of the tissue which they disorganize and dissociate. Each of them we may conceive as seizing an albuminoid molecule of humour or tissue, decomposing it, assimilating a part, growing rapidly, and thus becoming a visible and measurable bacterium. But when it has gone thus far, it terminates its career ; it has expended its potential energy. As to the size of these germs, the preceding considerations seem to indicate that they cannot be much larger than the albuminoid molecule. They probably may vary between the fifty and hundred-millionth part of a millimètre. The size of the most complicated chemical molecules, has, according to Thomson and Gaudin, an average value of ten to twenty-millionths of a millimètre. Why is water charged with bacteria not toxic? Papillon asks. Because it is not, like blood, in conditions favourable to the nutrition and development of the germs of bacteria, which require albuminoid matters for their growth. Why is comparatively fresh blood more toxical than blood in full putrefaction? Because it is richer in virulent germs than liquids in which predominate perfect bacteria already destitute of potential energy. Why does septicæmic "cultivation" exalt the injurious properties of blood? Because as the series of inoculations advances, the proportion of germs increases above that of adult bacteria.

ticæmic blood, it is admitted by the majority of those who have paid any attention to the subject, that although the presence of these organisms is a characteristic of the animal fluids in Septicæmia, little is as yet known of the part they play in the production of the septic virus, or "sepsin," as the supposed active or toxic principle is named.

Whichever way the question may be ultimately decided, it cannot be denied that the presence of these bacteria or bacteridia demonstrates the septic qualities of the blood in Anthrax; and although they may also be met with in putrefying blood from other than Anthrax-affected animals, this only proves that it offers the conditions necessary for their existence: conditions which are already present in Anthrax blood before death has taken place. The tendency of such blood to decompose rapidly, even during the life of the animal, is shown by the formation of Anthrax tumours and emphysema, as well as crepitating erysipelatous tumefactions of the skin (crepitating Anthrax), with bubbles of gas in the blood, and rapid putrefaction after death.

In the pernicious malarial fever of man, the spleen is enlarged, friable, and of the deepest claret colour, and bacteria have been found in swarms in the blood, and also in abscesses.

SYMPTOMS OF ANTHRAX IN GENERAL.

The manifestations of Anthrax observed in the living animal, vary according as the disease runs its course as a general, localized, or non-localized blood disease. In the first, death is usually rapid; while in the other, besides the symptoms due to alteration of the blood, there are also those occasioned by the disturbance of the circulation and local nutrition.

The first form, properly speaking the type of the disease, is that which is usually designated "splenic apoplexy," or "anthrax fever" (French: *Fièvre charbonneuse;* German: *Milzbrandfieber*); the second is characterized by the localization of blood and exudats in various tissues and organs, and is usually known as "carbuncular" or "anthracoid erysipelas" (French: *Erysipèle charbonneux, Affection carbonculaire;* German: *Karbunkelkrankheit, Rothlauf*).

ANTHRAX FEVER.

This form is characterized by its extremely rapid course, and the action the septic blood exercises on the nerve centres. There is no apparent localization—at least, during life. Though its course is generally brief (sometimes only five to ten minutes), yet it does not always terminate with the same degree of rapidity, nor yet exhibit the same extreme symptoms; it, therefore, offers several varieties. In one variety, one or more of the best-conditioned and robust animals are suddenly struck down in a herd or flock which, until then, exhibited no traces of the disease; they fall as if shot, or slain by a thunderbolt, while grazing, feeding in the stable, travelling, &c., and rise no more. This is the "apoplectic variety" (*Charbon foudroyant; Milzbrand-apoplexie*). In other cases, the animals commence to tremble and stagger; the breathing becomes hurried and the pulse very rapid, while the heart beats violently; blood flows from the nose, mouth, and anus, and death soon supervenes. Cerebral hæmorrhage is never observed in these cases; death appearing to be due to suspension of the functions of the spinal cord, and consequently of the respiratory and circulatory movements dependent upon it.

Sometimes the disease is less rapid in its course; the animals apparently rally from the first attack, but soon there ensues a second, to which they succumb. In the interval, the creatures remain drowsy, tremble, and their excretions are bloody; but an intermittent variety has been described, in which the symptoms almost entirely disappear between the attacks. In other cases, according to the part of the nervous system involved in the blood alteration, the animals exhibit excitement or delirium (*Milzbrand wuth*), or there are symptoms of paralysis from the very commencement. The general temperature of the body is diminished: a change which is perceptible on the surface of the skin. At the commencement of the disease, however, the thermometer in the rectum shows an increase, ascending to 41° or 41·7° Cent. (105·8° to 107° Fahr.) with cattle; descending, however, somewhat suddenly to 37° (98·6° Fahr.), when the malady is about to terminate

fatally. Should the disease continue for a certain period, changes in the temperature are frequently noted; it rises to about 41° in a few hours, descends to 39°, ascending again to 41°, and so on. But whenever it falls below the average, a fatal result is inevitable.

With animals in poor condition, and especially when the disease has prevailed for some time, its progress is less acute and rapid, even during localization; it may then extend over several days, and a small proportion of recoveries may be noted.

Such are the general symptoms of Anthrax fever. We have now to notice the carbuncular form of the disease.

CARBUNCULAR FEVER, OR ANTHRACOID ERYSIPELAS.

Localized Anthrax presents itself in two forms or varieties: as an "anthracoid erysipelas," and a "carbuncular disease," in which tumours of variable volume appear. In both varieties, but particularly the first, there is a characteristic infiltration of yellow, or reddish-yellow gelatinous matter diffused in the skin, the connective tissue, and between the muscles; in the second variety, this effusion or exudation is circumscribed in the form of tumours located in the skin, mucous membranes, or subserous connective tissue, and elsewhere. In both varieties there is a great tendency to sanious degeneration and necrosis; and as the infiltrations increase, there is often observed a marked diminution in the febrile phenomena; while their disappearance is not unfrequently accompanied by a very notable exaggeration of the general symptoms, and death usually ensues quickly. The functional disturbance—such as dyspnœa, retention of urine, constipation, &c., varies according to the seat of the tumours.

The septic decomposition of the blood and the venous congestion—partly depending upon the alteration which has taken place in this fluid, and partly on the modifications in the circulatory and respiratory movements—are the cause of the hæmorrhagic extravasations that are remarked in the diverse regions, the tendency to sanious and gangrenous destruction of the tissues and gelatinous exudations, and also of the development of the diffused or circumscribed tumours whose produc-

tion is so often accompanied by inflammatory phenomena. The latter often disappear rapidly by a process of desiccation or destruction. The very frequent occurrence of hæmorrhage is perhaps also favoured by a rapid and material modification in the capillaries, whose walls become less resisting and more readily ruptured; but this alteration would, of course, be only a consequence of the alteration in the composition or quality of the blood.

As we have already remarked, the blood is much changed in its physical characters, the veins are gorged with that fluid, and particularly those of the subcutaneous connective tissue, the serous and mucous membranes of the intestines, the lymphatic glands, and the parenchyma of organs. There are always voluminous, sometimes enormous, splenic tumours, and the parenchyma of that organ is transformed into a violet or black fluid mass; in some cases the gland is emphysematous; in others its capsule is torn, and the pulp is found in the abdominal cavity. The liver, kidneys, and lungs are greatly enlarged in volume, congested, and friable. More or less considerable extravasations of blood are met with in the subcutaneous subserous, or submucous, connective tissue; as also in that surrounding the large blood-vessels in the chest, in the muscular tissue and different parenchymatous organs, the texture of which they frequently destroy in patches. There are also the yellow or reddish exudations into the skin and subcutaneous tissue—as in the localized forms—between the muscular fibres, in the subserous connective tissue of the mediastinum—as in what the English farriers termed "anticor" (from the French *avant-cœur* or *anticardia*)—around the large vessels, in the connective tissue of the peritoneum, and particularly in that surrounding the kidneys and in that of the intestines; these exudats have a special tendency to become gangrenous, or broken up into sanious accumulations.

Another feature in the pathology of Anthrax, is that the cadaveric rigidity *(rigor mortis)* is very imperfectly developed, and the body rapidly passes into a state of putrefaction—indeed so rapidly that in a very few hours after death, and more especially if the weather is warm, the pathological

changes are no longer well defined, but are complicated with those resulting from necroscopical phenomena. A bloody fluid flows from the nose and mouth ; the vagina and rectum are of a deep-red colour, and most frequently much everted. In removing the skin, a quantity of black viscid blood flows from the cut vessels, and its inner side, as well as the connective tissue beneath it, shows numerous hæmorrhagic extravasats, or is infiltrated with the gelatinous yellow-tinted material so frequently alluded to. The muscles are friable, as if they had been cooked, and are often pale, but sometimes have a deep reddish-brown, violet, or black hue, from imbibition of the colouring matter of the blood.

Such is a general description of Anthrax ; and we have now to delineate the symptoms of the disease as it appears in the principal domesticated animals. It must be remarked, however, that these animals are not involved to the same degree in every country ; on the contrary, while one species suffers severely in a particular region it may be nearly exempt in another. In Russia, for instance, the equine species appears to be far more liable to attacks of Anthrax than in this country. It is the same with cattle, sheep, and other animals in different regions. In some of these all the varieties of Anthrax are observed, while in others only two or three are known to exist. This diversity compels us to notice Anthrax more in detail, with regard to its symptomatology and forms ; even though the latter may not all be at present recognized in this country. In such an immense empire as that of Great Britain, they must prevail somewhere or other, and this work is not written for England alone.

SYMPTOMS OF ANTHRAX IN THE HORSE.

1. *Without Special Localization.—Apoplectic Anthrax.*

The most acute form of Anthrax—the apoplectic—is somewhat rare in the horse, and has perhaps been most frequently observed on the continent ; though cases are recorded, but, through an error in diagnosis, under other names in the

veterinary literature of this country. I have only witnessed two cases in England; though during the intense summer heat in the North of China I had several.

The horses most frequently attacked are those which are young, fat, vigorous, and in excellent condition, and the onset of the malady is extremely sudden. It generally takes place while the animal is at work: when it suddenly begins to tremble all over, the head is tossed about wildly, saliva flows from the mouth, and in a very brief space the horse reels about, falls, and dies in the midst of convulsions. Or it may rally sufficiently to travel a short distance; but another attack commences in a short time, and the animal perishes. In the interval between the attacks, it remains in a profoundly drowsy condition, the eyes are prominent, and the head hanging low or resting on the manger, if in the stable: the body may even be lying against the wall; if recumbent, it is extended to the full length of its collar-rope. When compelled to move, it staggers as if intoxicated. Death takes place in a few hours.*

Another variety, less rapid in its course (lasting for three or four days), but also very fatal, is witnessed. The first symptom is a particular drowsiness and stupidity, with much prostration. The animal is uneasy, paws, changes its position, looks back at its flanks, and acts as if it were suffering from continuous or intermittent Colic. When it walks it appears to be extremely weak, the hinder extremities sway from side to side, and it stumbles very much. The skin is harsh and dry, and in some rare instances, if pressed towards the loins or sides, crepitation may be produced. There are general or partial tremblings, as well as alternating cold and hot sweats, more particularly observed towards the root of the ears, chest, behind the elbows, and at the flanks. The external lymphatic glands are sometimes swollen. With some nervous animals, the stupor is replaced by violent excitement and irritability.

* An extraordinary epizoöty of what may have been this disease, that attacked the horses in Yemen, Arabia, in the fourteenth century, and caused great loss, is recorded in "Animal Plagues," page 95.

In all cases, the breathing is either deep and laboured, or shallow and hurried, and irregular ; and up to this period the appetite may remain unaffected. The eyelids are swollen, and their lining membrane is infiltrated and yellowish-red in colour. The pulse is small, weak, and often imperceptible, though the heart beats violently and confusedly, with a metallic kind of sound ; in some instances its contractions are intermittent. This contrast between the arterial and cardial pulsations is characteristic of great alterations in the blood, and particularly of Anthrax fever.

In some rare cases these symptoms gradually disappear ; in others they continue for a certain time without increasing in severity, and a critical eruption may occur. But usually they become aggravated ; suddenly great agitation is manifested ; the clonic contractions of the muscles assume a convulsive character, and the perspiration is copious ; the animal gnashes or grinds its teeth, and the symptoms of Colic are urgent, while the expression of the face is haggard, depressed, or very dull. The visible mucous membranes have a brownish tint, and are much infiltrated ; a red-coloured serum exudes on the surface of that covering the nasal septum and lining the eyelids, as well as from that of the rectum, which is much everted from the continuous expulsion of very fluid fæces mixed with blood. The respirations are irregular and tumultuous, the nostrils are widely dilated, the face looks pinched and betrays extreme anxiety, the body becomes cold, the animal staggers at every step, and at length falls, struggles convulsively, and soon succumbs.

2. *With Localization.—Carbuncular Anthrax.*

Anthrax in the horse is not so frequently marked by local symptoms, perhaps, as in some other animals, especially those belonging to the bovine and ovine species. Nevertheless, as a critical eruption of so-called "anthrax pustules," or "tumours," is sometimes present in certain epizoöties in which horses, as well as other herbivorous animals, are involved, we will briefly allude to this eruption before describing what appears to be a special form of the disease in the horse.

The development of these tumours is supposed to be owing to the morbid alteration of the blood not having attained such a degree as in Anthrax fever, or the vital resistance of the animals is greater. However this may be, at a certain stage of the febrile symptoms there is an external eruption in various regions, which the older writers, supposing the disease to be different as it appeared in one part of the body or another, designated according to its seat. Thus we had "blaine of the tongue" or "tongue evil" (Glossanthrax), "black quarter" (anthracoid Erysipelas), &c., the several forms, however, being but a different manifestation of the same malady.

These tumours are developed in the subcutaneous connective tissue, particularly where it is loose and plentiful, in the interstices of the muscles, and in the lymphatic glands. In the various animals they have their special affinities for certain regions; these are the submaxillary space, the upper part of the throat, lower portion of the neck, entrance to the chest, the breast, behind the shoulders, on the back and sometimes the belly, the flank, inguinal region, substance of the tongue, &c. If the part where an Anthrax tumour is about to appear is covered with hair, this will be observed to stand erect, and when the hand is passed over the place, a slight crepitation may be felt; there is also increased sensibility. In some cases there soon appears a nodosity, simple or multiple, about the size of a small nut, and round or irregular in outline; this is seated in the connective tissue or in the skin, and is adherent, and as it were pedunculated, at its base. Ordinarily it is little sensitive in itself, the pain the animals manifest on manipulation being due to the increased sensibility of the surrounding parts. In other cases, the tumour suddenly commences by the appearance of a soft, doughy, œdematous, crepitating, and undefined swelling. If these are numerous, ridges, or lines of communication of the same character, run between them.

When the eruption takes this form, the tumours are quickly developed, and in a few hours invade all the neighbouring parts, extending in every direction with equal rapidity; the

skin covering them becoming tense and hard like parchment, and crepitating on pressure. As they extend they become cold and insensible, a variable number of phlyctenæ arise on their surface, and these quickly bursting, give issue to a serous irritant fluid. If the hand be now passed over the swellings, a kind of subcutaneous trembling or quivering will be felt, which has been attributed to the crepitation produced by the disengagement of the gas resulting from the decomposition of the gangrenous tissues; this gas collects in the meshes of the connective tissue, and thus renders the part emphysematous. This is a special feature of the Anthrax tumour.

If an incision be made in the swelling at this stage, the horse does not manifest any indication of pain, and there flows from the incision a black or reddish serum, extremely corrosive, and mixed with fœtid gas, which causes a noise as it escapes like the crackling of paper or the bubbling of boiling water. Sometimes passive hæmorrhage ensues after the incision, and continues until death.

There are cases observed in which the tumours appear without being preceded by any very marked general symptoms; but such instances are only witnessed when the epizoöty is very benignant, towards its decline, or in sporadic outbreaks, and when fever has been present; though it has been so slight as to pass unobserved, unless carefully looked for. This Anthrax fever is always severe in proportion to the degree of septicity of the blood.

In whichever form the tumours are developed, their course is always the same, being most rapid the earlier they appear. In from two to eight hours they attain a considerable size, and the tissues mortify as they are invaded. As they are developed the animal appears to obtain relief—the fever abates and the urgent symptoms vanish. But when they have attained certain proportions, general symptoms become apparent; these vary, according as the malady is to terminate favourably or otherwise. In some rare instances (and the French veterinary surgeons in Africa have furnished several of these) the material which constitutes the tumour is suddenly absorbed, abundant sweats, an increased flow of urine, or a serous fœtid diarrhœa

ensue, and the animals promptly recover. In other cases, by surgical means, the evolution of the tumours is limited to a certain extent; they reach the suppurative stage, and finally disappear by resolution. In ordinary circumstances, however, it happens that after the interval which follows the eruption, the organism being incapable of eliminating the morbid element, the tumours vanish; but this is only a transference, for the disease assumes all the characters of Anthrax fever without local manifestations, the general symptoms reappear, and running their course with startling rapidity, the animal perishes within twelve hours.

Such is the character of this form of Anthrax, and we will now proceed to describe the symptoms of a variety which affects the horse, and has long attracted the attention of continental veterinary surgeons, especially those of Germany; though I am not aware that it has been described by any British writer, at least in recent times.

Anthrax Typhus:

From the symptoms and necroscopical appearances observed in this disease, there can be no doubt as to its being a variety of Anthrax. But with regard to the propriety of the designation which the best authorities have given it, there may be reason for doubt. In the first place, the proliferation of cellular elements in the intestinal glands, and the subsequent transformations these undergo in man, are not observed in this equine malady, and the eschars and ulcers are different. And in the second place, there are only the localizations in the skin, and the subcutaneous hæmorrhage, to furnish a comparison between it and the spotted Typhus of the human species. And besides, as has been carefully pointed out by more than one writer, when the nature of these local changes and the transformations they undergo, as well as the condition of the blood and the constant presence of bacteria in it, are considered, the horse Typhus bears a far greater resemblance to the localized Anthrax of the other domesticated animals than to the spotted Typhus of man. In addition to this, it is not rare to witness cases of "apoplectic anthrax" occur in the same

locality, or even in the same stable, before or during the prevalence of this so-called Typhus. The designation is, therefore, incorrect and misleading, both with regard to the symptoms and the pathological anatomy of the malady.

The disease usually commences with shivering, considerable prostration, dulness, and indifference to surrounding objects; there is loss of appetite, the respiration and pulse are quickened, and the fæces are more abundant and fluid. These vague symptoms continue sometimes for one or two days, and might give rise only to a suspicion of the existence of intestinal Catarrh. In many cases, however, in a few hours other and more characteristic symptoms are developed. On various parts of the body there appear well-defined tumours, from the size of a nut to that of a fist; these are usually hot and painful at first, but soon become indolent, and their temperature falls to that of the neighbouring parts. These Anthrax or Anthracoid tumours most frequently appear on the abdomen and chest, along the back, on the croup, and the inner surface of the thighs; they sometimes disappear very rapidly, to reappear as suddenly in other regions of the body. In other cases there are developed extensive, hot, and painful swellings, which pit on pressure, and locate themselves on the limbs: extending gradually from the coronet as high as the elbow or stifle, where their limits are well defined, and are often of such a size that the extremities cannot be moved. Similar tumours are often developed at the inferior part of the head, around the nostrils, which are in consequence greatly obstructed; the lips, even, may be involved, become hard as wood, and quite immovable. The respiration, as well as the ingestion of food, is carried on with difficulty; the swelling continues to extend along the jugular furrow towards the chest, and the lower part of the abdomen to the sheath; when it attains the latter, the emission of urine takes place with difficulty. If the recent swellings are incised (as is frequently done, to the detriment of the animal), it is perceived that they are due to a yellow fibrinous exudat that forms a compact or gelatinous mass, traversed by numerous extravasats.

About the same period, the mucous membranes show altera-

tions. That of the nose is intensely red, tumefied, and covered with numerous punctiform or band-shaped extravasats; in places it is infiltrated with yellowish exudations, and here and there has a violet tinge from extravasated blood. Analogous lesions are frequently observed on the membrane lining the lips; though rarely that on the gums, which, like the entire mucous membrane of the mouth, is intensely yellow. A viscid discharge of a disagreeable colour and frequently streaked with blood, commences from the nostrils, and the mouth is filled with a tenacious saliva.

At first the respiration is but little disturbed, unless the swelling around the nostrils hinders the admission of air; most frequently there are symptoms of bronchial Catarrh. The pulse varies from sixty to seventy per minute, and is ordinarily full and compressible; the pulsations of the heart are sometimes marked, at other times imperceptible; the appetite is nearly lost, the animal perhaps only eating a little forage. Thirst is present; the fæces are ordinarily softer than usual, and pale in hue; the urine is dark, often blood-coloured, and its emission is rare, difficult, and frequently accompanied by tenesmus.

The indifference and stupor are sometimes so great that the horses appear to be fixed, resting their head upon the manger and their body against the wall; they rarely manifest any uneasiness or excitement.

In those cases in which the deposits are more especially localized in the gastro-intestinal mucous membrane, symptoms of Colic may appear at times; the position is then changed frequently, the animal paws and looks at its flanks, or throws itself upon the ground, lies upon its back with the limbs flexed, or rolls, jumps hurriedly up, and in other ways indicates the suffering it experiences in this region. If the disease is more serious, the salient parts of the body are injured in consequence of the violence with which the animal throws itself down, or sloughing wounds appear from the prolonged decubitus.

If the course of the malady is rapid, the eyelids are in some cases considerably swollen, so that they can scarcely be opened. Indeed, complete loss of the eyes may ensue from

the considerable hæmorrhage that sometimes takes place in them. Röll has witnessed several instances of this kind.

The course of the disease is not always the same. It is usually most favourable in those cases in which the morbid phenomena are confined to the skin, and the digestive organs are little, if at all, involved. The tumours persist for one or more weeks without any notable modification, or they slowly disappear; at the same time the appetite returns, the dulness and prostration diminish, and the health is restored in six or eight weeks; though for a considerable period the animal is incapable of undergoing any kind of severe exertion, from the weakness of its nutritive powers.

In these cases the duration of the malady is considerably increased, in consequence of the skin cracking at the places where the tumours were located, especially in front of the hocks, behind the knees, and at the pasterns. At these parts there is a discharge of a transparent yellow serum, which sometimes forms a thick crust; or gangrene may cause the loss of a portion of the skin in these regions. In such a case, the eschar is gradually detached from the neighbouring parts, and causes a considerable loss of substance; the mortified connective tissue and fragments of exudat are eliminated; deep fistulæ are formed at times; and even with careful surgical treatment months may elapse before the animal is perfectly recovered.

The tumefaction of the lower part of the head may attain such dimensions that the nostrils are entirely obstructed, and asphyxia becomes imminent. This dyspnœa is also usually much increased by the considerable infiltration that takes place in the nasal membrane, which almost closes the air-passages. The tumefaction that sometimes occurs around the upper part of the windpipe may also render asphyxia imminent, and necessitate the use of the tracheotomy tube. But even with this, in these cases the animals frequently succumb to pulmonary œdema or gangrenous Pneumonia.

When symptoms of intestinal derangement appear at the commencement of the disease, the result is much more unfavourable, and death is in the great majority of cases inevi-

table. There are the indications of Colic in different degrees, and Diarrhœa: the fæces being very fœtid, and frequently mixed with blood, membranous exudats, or gangrenous *débris*.

The cutaneous tumours may disappear suddenly, often within one or two hours; so that an animal which appeared as a deformed mass at one time, nearly all at once regains its normal outline. But this is a bad sign. Ordinarily the most violent symptoms of Colic ensue upon the subsidence of the tumours, and the animals generally perish in a few hours, the cases being quite exceptional in which recovery takes place. Sometimes the swellings reappear in a short time, the indications of Colic vanishing; this alternation may be repeated several times.

Pneumonia often complicates the disease, particularly in horses in low condition, and frequently terminates in more or less extensive gangrene of the lungs. A physical exploration of the chest gives evidence of this condition, which, as with œdema of the lungs and glottis, is often the immediate cause of death.

On the nasal mucous membrane, the infiltration may be followed through all its stages to gangrene, ulceration, or recovery. The membrane and the matter with which it is infiltrated are, as a general rule, transformed by gangrene into a yellow eschar at the places where the spots—circular or elongated, from the size of a grain of millet to that of a pea or fourpenny-piece, and bluish-red in colour—were observed. These spots are most frequently found in the mucous membrane of the nasal septum, and are due to the presence of a yellow gelatinous exudat mixed with extravasated blood. This eschar, still surrounded by infiltrated tissue, gradually extends until the whole is transformed into a yellow saffron-coloured mass, which is only separated from the adjacent mucous membrane by a narrow shallow depression at first, but afterwards wider and deeper; it is subsequently detached at the borders, and becomes friable and spongy; soon adhering only by a single point, it hangs loose in the nasal cavity. When it becomes entirely detached, an ulcer is left, the outline of which corresponds to the preceding infiltration. It

may penetrate as deeply as the submucous connective tissue; and if there is another ulcer on the opposite side of the septum, this may be completely perforated. The borders of the ulcer are considerably infiltrated; but if recovery takes place, this disappears, granulations spring up from the bottom, and in time nothing remains except a slightly depressed cicatrix, or, if the cartilage has been perforated, a loss of substance circumscribed by a thick border. The slight infiltrations do not mortify, but are probably absorbed after having undergone fatty degeneration.*

SYMPTOMS OF ANTHRAX IN CATTLE.

1. *Without Special Localization.—Apoplectic Anthrax, Anthrax Fever, Splenic Apoplexy.*

Anthrax in its various forms affects the cattle of Western, and probably all, countries much more frequently than horses. The apoplectic form is particularly fatal, and offers analogous symptoms to those observed in the horse; it is frequently the precursor of an extensive epizoöty of Anthrax.

Ordinarily, it is the best-fed and most vigorous which are attacked; and where oxen are employed in draught, it is generally while at work that they are seized. The animals suddenly fall, and die in a few minutes in the midst of convulsions, a blood-coloured foam escaping from the mouth and nostrils. It is not at all uncommon to find animals, which appeared to be in perfect health the previous evening, dead in the morning.

In other instances, however, the course of the malady is less rapid. There is a cessation of rumination, and loss of appetite; weakness or prostration ensues, with stupor or great excitement; shivering and general or partial sweatings ap-

* A severe outbreak of this disease occurred in Japan in the summer of 1860, among the horses purchased for the campaign in the North of China. I had a good opportunity of studying the malady among these animals. It was very fatal, and the swelling at the lower part of the head was always a most marked symptom.

pear, or the skin, which is harsh and dry, is hot and cold alternately; tremblings manifest themselves; along the spine and the ribs pressure causes pain; the muscles in some regions, especially that of the neck, contract spasmodically, and these contractions are often accompanied by plaintive lowing. The contractions become more marked as prostration increases; if the animal is made to move, it staggers and stumbles, and progression is nearly impossible; it often falls, and has great difficulty in getting up. About this period, a fœtid and sanguinolent diarrhœa sets in, accompanied by abdominal pain, which the animal indicates by frequently looking to the flanks. The expression is that of stupor, and the dull, dead appearance of the eye is very characteristic; at the same time the heart-beats are loud and tumultuous, and the pulse is small, very quick, and irregular; the temperature of the body may be high, but the legs and face are cold; the respiration, at first sighing and plaintive, soon becomes panting; the muffle is dry, and the mouth cold and filled with foamy saliva; the tongue is pendent and violet-coloured, the buccal membrane yellow, and the animal grinds the teeth; the conjunctival membrane is of a black or reddish-violet hue; the eyes appear to protrude more than usual beyond the orbits, and the pupils are dilated. The abdomen becomes distended, the animal falls, blood flows from the nostrils, and the foam from the mouth is blood-coloured; and convulsions, especially of the limbs, commence, and in some animals are so severe that it is dangerous to go near them. Usually, however, the prostration is extreme, the body is cold, and the animal either perishes during one of these convulsive attacks, or in the calm which succeeds it. Death, the usual result, may occur in a few hours. If there is no remission, it may take place in two hours; but if the alteration be not so great, or the power of resistance stronger, the animal may linger from twelve to thirty-six hours.

It must be added, nevertheless, that some cases, with less intense symptoms, may live for several days, and that these are the rule in certain localities, and at a certain period in the course of an epizoöty. The disease in these cases might, with

justice, be distinguished from the more severe or apoplectic form, and receive the designation of Anthrax fever.

It usually commences with a rigor that may easily pass unperceived, and this is followed by a high temperature; there is the usual debility and indifference, with obtuseness of the senses, and low hanging or unsteady head, and fierce expression. The animal bellows and strikes at the abdomen with its hind feet, and the eyes appear to start from their sockets. The temperature of the body is constantly changing, the limbs being usually cold; the pulse is very quick, and almost imperceptible; the mucous membranes are hot, and reddish-yellow in colour; the muffle is dry, and the teeth are continually ground. The appetite and rumination are frequently suspended altogether, and there is sometimes thirst present. The fæces are dark-coloured, dry, and often mixed with blood, and it is not unusual to observe symptoms of violent Colic.

With milch cows, the secretion of milk is considerably diminished, or quite suppressed; but so long as it continues, it does not offer any alteration, except in some cases it has a dirty light-blue tint, is viscid and insipid, and quickly putrefies.

In those instances which last only from twelve to thirty-six hours, these symptoms rapidly increase in intensity, and the animal dies in the midst of convulsions, which are ordinarily accompanied by the involuntary discharge of sanguineous fæces. In the cases which are more protracted, there may occur an apparent amelioration of the symptoms, and the animal seems lively; at the same time the appetite returns to some extent. Nevertheless, prostration increases; the senses become more blunted, the respiration and pulse quicker; the secretions of the mucous membranes more abundant; dark-coloured blood escapes from the mouth and nostrils, and the Diarrhœa which ensues is largely composed of blood; the abdomen is tympanitic; the body is cold; convulsions appear; subcutaneous emphysema is developed along the back; and the animal generally succumbs in from the third to the seventh day.

2. *With Localization.—Glossanthrax.*

The localized varieties of Anthrax in bovine animals are numerous. One of the most remarkable, perhaps, is one which, though very common in this country and on the continent in former times, is now becoming somewhat rare as an epizoötic, and even as an enzoötic, disease. This is "glossanthrax," which has some striking points of difference from the other varieties, and is characterized by an eruption of vesicles or "phlyctenæ" on the dorsum, and at the base, sides, and about the frænum, of the tongue; as well as on the gums, palate, inner aspect of the lips, and even on the cheeks: their appearance being seldom accompanied by fever. The vesicles are at first white and translucid, but they soon change to a gray, yellow, violet, and finally a blackish disagreeable colour; and they may either be situated directly on the mucous membrane, or on the summit of a small submucous tumour. They increase rapidly in size, especially when few in number, and may become as large as a hen's egg. The tongue swells, and becomes pendent, or protrudes only beyond the incisors, which compress and mark it; at the same time, it assumes a bluish or black hue. The vesicles rupture, and discharge an acrid corrosive fluid, leaving ragged ulcers, red in the centre and black around their margin; or they are covered by an eschar, beneath which ulceration goes on rapidly, to the destruction of the texture of the tongue, lips, gums, cheeks, and other parts involved. When the vesicles rupture, the phenomena of Anthrax fever appear; the parts adjoining the ulcers are greatly tumefied; the animal manifests indications of intense pain; a thick stringy mucus, mixed with blood and ichorous gangrenous sanies of the most acrid description, flows in abundance from the mouth; the tumefaction attacks the lips and cheeks more severely, and reaches the base of the tongue, pharynx, larynx, and soft palate, and the creature may die of asphyxia, if not of the disease itself, in a few hours—usually from twenty-four to forty-eight—after the appearance of the vesicles.

In those cases in which a judicious curative treatment has

been adopted, and the progress of the disease is checked, the ulcers in the mouth may persist for a somewhat considerable period, and much hinder the prehension and mastication of the food.*

As the local alterations precede the fever, Glossanthrax does not appear to be due to primary miasmatic infection, but to transmission by contact or inoculation.

External Anthracoid Tumours.—Carbuncular Fever.

We have already alluded to this form, and mentioned that the tumours may appear in various regions of the body—such as the back, sides, a hind limb, at the breast, neck, dewlap, and elsewhere. These may be circumscribed or diffused; the latter are most frequent about the lower part of the chest and abdomen, and the limbs, and possess all the characters of those which appear in the so-called Typhus of the horse. They are accompanied by well-marked indications of Anthrax fever, and may be due to local infection, as well as general causes. Small in size at first, these tumours usually increase rapidly, and often attain an enormous size. When they begin to be developed they are hot and painful, but soon after they are cold and indolent. When cut into, they are found to be composed of a firmly coagulated, yellow exudat, mixed with numerous black hæmorrhagic masses, but the changes which

* Outbreaks of Glossanthrax in the equine species are frequently recorded in the annals of veterinary pathology. A notable one occurred in England in A.D. 1252, and another in Silesia in 1718. *See* "Animal Plagues," pp. 76, 230.

It has also appeared in the cervine tribe, "tongue evil" being by no means rare among deer on the North American continent.

Two most extraordinary epizoöties of Glossanthrax occurred in 1682 and 1731. The first appears to have spread from west to east, through Switzerland, France, Germany, Poland, and Holland, and travelled, it was reported at an uniform rate—nearly two German miles in twenty-four hours. Cattle only seem to have been attacked. In the outbreak of 1731, however, all the domesticated herbivores were involved, and the transmissions to other species were remarkably frequent and fatal. It spread in France, Switzerland, Germany, and Italy, commencing its extension early in 1731, and terminating its career in Ferrara and the Romagna, where horses, cattle, sheep, and pigs suffered most severely in 1732.

occur in them are not always the same. The skin covering them, as has been said, is dry and crackling, and the infiltrated matter becomes necrosed, and is eliminated by the suppurative process which occurs in the neighbourhood; or, as is more frequently the case, the tumours open spontaneously after a day or two, in one or more places, and a sanious matter or a viscid blood-coloured fluid escapes. The borders of these orifices assume an unhealthy aspect, and become callous, and the gangrenous destruction of the skin and subcutaneous connective tissue extends.

The evolution of these tumours is sometimes accompanied by a diminution in the intensity of the general symptoms; an improvement in the animal's condition is observed, and recovery may take place; or the fever may reappear with renewed vigour, and death ensue in from three to seven days after the commencement of the characteristic symptoms. It is the same if the tumours retrocede, or if they are developed in the vicinity of important organs, such as the larynx and trachea, or in such a region as the head, &c.

Not unfrequently gas is disengaged in them, and particularly in those which are diffused and not very prominent, as well as in those on whose surface new dry eschars are formed. Slight pressure on these produces crepitation. Extensive sloughing of the skin may occur without the previous formation of tumours.

When recovery takes place, there is sometimes a permanent loss of tissue where the tumours have been.

Anthracoid Tumours in the Rectum.

In this variety, in addition to the ordinary symptoms of Anthrax fever, the fæces, usually dry and hard, are mingled with black, tar-like viscid blood, and tenesmus is constant during their expulsion.

The mucous membrane of the rectum is at the same time very hot and swollen.

Death may occur very rapidly—within a few hours, or not until after some days.*

* Röll mentions that certain authorities have classed among Anthracoid diseases a rare bovine malady (*Sterzwurm*), which is characterized by

SYMPTOMS OF ANTHRAX IN SHEEP.

1. *Without Special Localization.—Apoplectic Anthrax.—Splenic Apoplexy.*

Sheep are more liable to the apoplectic form of Anthrax than the other domesticated animals, and particularly those which are well bred. In some countries it is most destructive, and especially in certain parts of France, Germany, Lower Hungary, and Scotland (where it is known as *braxy* and *pining*); in these it is an enzoötic malady, and its destructiveness is owing to its prevailing for several consecutive years, its continuing its ravages uninterruptedly, and its contagiousness. Old and young are equally affected.

The disease appears to be on the increase in England, probably owing to higher breeding, and feeding of a more unnatural kind. It is not confined to low-lying, swampy localities, but may occur on mountainous pastures and dry grassy farms. It is a summer and autumn disease, and has been by many good observers ascribed to coarse, rank, woody herbage.

The symptoms are analogous to those already described for this form in the equine and bovine species. There are no apparent precursory signs; the animal, lively and evidently in perfect health, is suddenly attacked, falls down while perhaps grazing, and perishes in convulsions in a few minutes; or it lies paralyzed and unable to get up, the respiration hurried and laboured, the eyes prominent, the visible mucous membranes deeply injected, and sanguinolent discharges from the mouth and nostrils. Death in these cases occurs in a few hours, in the midst of convulsions. In some cases which are not so rapid in their course, it is observed that the sheep is dull, refuses to eat, carries the head low and the back elevated, appears uneasy, getting up and down frequently, and does not

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ulcers on the tail, and which extend to the ligaments of the coccygeal bones, causing the loss of a portion of the organ. It is treated by ablation of the tail above the diseased part, and cauterization of the wound. The "Bursautie" ulcer of India, so common among horses, has been conjectured by Heusinger to be Anthracoid in its nature.

micturate; if the flock is moving, it drops behind, perhaps staggers, and goes slowly and gently. The hair on the face is dry, as is also the wool, which is "clapped" to the sides. If bled at this time, the blood is found to flow very tardily, and to be black, thick, and syrupy.

The animal appears to be out of breath and excited; the nasal and conjunctival membrane is deep red, while that of the mouth, and especially on the lower lip, is marked by characteristic patches of a light violet hue; the pulse is small and hurried; the beats of the heart tumultuous, and the temperature of the body, where there is no wool, is lower than in health; symptoms of abdominal pain may be present, with constipation or diarrhœa. If any doubt exists as to the nature of the disease, Reynal recommends that the animal's nostrils be closed for a few seconds by the fingers; this will cause it to micturate, and the urine will be blood-coloured if Anthrax fever is present.

The disease quickly arrives at its full development; general tremblings set in, and the animal can no longer stand; there is profuse lachrymation, and the vision is impaired; blood is discharged from the nose, anus, and vulva, and œdema sometimes occurs at the neck, lower jaw, breast, and flank, or indications of putrefaction become apparent. Convulsions appear, and soon after the sheep dies. These symptoms succeed each other rapidly, death taking place in one, two, three, or four hours, especially during hot weather; at other times the disease continues longer, and slight variations in the symptoms, which are, of course, less acute, are often noticed.

2. *With Localization.—Carbuncular Fever—Anthracoid Erysipelas.*

External tumours are rarely seen in the sheep, and then only about the head and udder. A diffused anthracoid Erysipelas is, however, frequently observed in different countries to affect sheep—usually the strongest and most thriving. After symptoms of fever, which may pass unobserved by the unskilled, the sheep begins to limp, or exhibits more or less stiffness in progression. If a careful examination

be made of the limbs, a dark-red or bluish tumour will be distinguished inside the thigh, perhaps; this is œdematous or crepitating, and soon becomes cold and indolent as it extends to the abdomen and chest, though it rarely reaches the neck and head. The epidermis of this tumour peels off, and a reddish, sanious, corrosive fluid exudes from the denuded surface. The accompanying fever is very intense; the abdomen is distended, and in some cases a sanguineous foam escapes from the mouth. Death may ensue in a few hours: rarely later than twenty-four to thirty-six.

Glossanthrax.

"Glossanthrax" is a much more unfrequent disease in sheep than cattle, though they are not altogether exempt from it; and it may appear among them during epizoöties affecting the bovine species, or only a small number may be attacked. The symptoms differ but little from those manifested by cattle, and unless relief is afforded by early treatment, sloughing of the tongue and tumefaction of the pharynx, larynx, and adjacent parts, with swelling of the head and neck, will produce asphyxia.

SYMPTOMS OF ANTHRAX IN THE PIG.

I. *Without Special Localization.—Anthrax Fever.*

Anthrax fever in the pig offers some modifications to that observed in the other animals, probably from its dissimilar constitution and organization. It has, however, its apoplectic and less rapid form, like the others; and these we will proceed to describe. It may first be observed, however, that in some countries Anthrax is most destructive in the porcine tribe, sparing neither sex nor age, and appearing in all seasons.

In the apoplectic Anthrax fever, the course of the malady is so rapid that death may ensue within an hour, and without almost any symptom or suspicion of disease. When the symptoms are observed, however, in the less acute attacks, or

those which are witnessed from the first, they are somewhat as follows: sudden loss of appetite, general prostration, and dulness; pendent ears; prominent and haggard-looking eyes; staggering gait; highly injected mucous membranes; rapid alternations in the temperature of the body; vomiting an unpleasant-looking, blood-tinted fluid; and death in convulsions.

2. *With Localization.—Glossanthrax.*

The pig is affected with "glossanthrax" or "stomanthrax," like the animals already alluded to, but much more rarely, and the symptoms are not very different. The same kind of dark-coloured vesicles appear on the mucous membrane of the mouth, but particularly on the palate and tongue, and are accompanied by an intense fever; ulcers form, sanious saliva flows from the mouth; the tongue swells and protrudes, becomes gangrenous, and may slough away. The progress of the disease is rapid; gangrene invades the pharynx; diarrhœa, accompanied by tenesmus and blood, sets in; and a fatal termination is almost inevitable, unless remedial measures are speedily adopted. The disease may run its course in from twelve hours to three or four days.

Carbuncular Anthrax.

"Anthracoid tumours" are also very much more rare in the pig than in the horse, ox, or sheep, their place being taken by erysipelatous patches to be described hereafter. There is, however, sometimes observed the formation of a small "pustule" the size of a haricot bean, accompanied by a most intense fever. This tumour appears in the laryngeal and parotideal region, and is deep seated; it is connected with, or perhaps dependent upon, a peculiar condition of the bristles growing in this region. A tuft of these—numbering half a dozen to twenty—becomes invaginated in a curious depression, or infundibulum, that forms usually a little below the parotid gland on each side, and between the lower jaw and windpipe. The process of invagination goes on, the bristles become hard and brittle, and if the slightest traction is made on them, the animal manifests indications of acute pain; at length they

disappear altogether externally, and begin to press upon, and even perforate, the larynx, producing symptoms of asphyxia. The throat becomes swollen, and the mucous membrane of the pharynx and larynx greatly thickens, producing a gradual diminution in the calibre of this region, until at last it is entirely obstructed, and suffocation takes place. The symptoms in the meantime are as follows: at first the pig has lost its appetite, is prostrated, deaf to the voice that calls it, and insensible to blows; it grows weak; the tongue becomes red, and the mouth very hot and full of saliva; the eyes look inflamed; the lower jaw is continually moving; the respiration is hurried, and the expired air is hot; there is sometimes diarrhœa. These symptoms increase in intensity; the animal is extremely uneasy, groans, cries, and grinds its teeth continually; the breathing becomes more and more difficult, and convulsions close its life.*

Anthracoid Erysipelas.

"Anthracoid erysipelas" in the pig (sometimes called in this country "the distemper," "measles," "hog cholera," "red soldier," "blue sickness," &c.), is, by some authorities designated "anthrax fever without eruption," "enteric fever," "typhoid fever," and "splenic apoplexy."†

* This malady, named "Soyon" or "Soie" in France, has given rise to much discussion as to its nature, and to the cause of death. Some authorities maintain that it is a form of Anthrax, while others assert that it is a more local disease, due to the recession of the bristles in the laryngeal region. Among the partisans of the latter opinion is Bénion (*Traité des Maladies du Porc*, p. 530), who concludes that it only consists in an invagination of the skin causing a deviation in the direction of the hairs, which, with their bulbs, are drawn into the little funnel-like depression, the tissue of which, in becoming developed, is transformed into an aponeurotic material enveloping these bristles; and that the root of the bristles, not the point, penetrates the larynx. But from the above symptoms, and also from the alterations observed after death, it will be seen that they bear a great analogy to those observed in Anthrax.

† This is a most fatal and destructive malady among pigs in this country, on the Continent, and in America and Australia. It sometimes prevails as an epizoöty, and sweeps off hundreds of these animals. It has been surmised, though I am not aware on what grounds, that this "hog cholera" is caused by the migration of an entozoon—the *Stephanurus den-*

We have placed it here, as it is marked by an eruption. It is the most common form of Anthrax in this animal. The premonitory indications of the disease are usually little marked, and frequently pass unperceived. The animal loses its liveliness, is prostrated, and has no appetite, but seeks cold water; the movements become difficult and unsteady, and it seeks to lie, burying itself beneath the straw; the temperature of the body varies, but the ears are hot and painful, and well-marked rigors may be observed; the tail is pendent, and the conjunctivæ of a brick-red colour; the respiration is hurried, and the pulse quick; the fæces hard and black; and nausea and vomiting may appear. Death may ensue almost as quickly as in the apoplectic form, to which this variety bears much resemblance at first. The snout assumes a leaden hue; there is anxiety and plaintive cries; the ears (first at the tips), belly, inner surface of the thighs, along the back, &c., become covered with red patches, which deepen in hue; the temperature of the body is lowered, particularly where the eruption appears, and these parts are covered with humidity, the epidermis and bristles being easily removed from them. The parts where the patches are located have lost their sensibility, for puncturing them with a sharp instrument does not cause pain; a yellowish fluid escapes from the punctures. The fæces become softened and mixed with dark-coloured fœtid blood, or are of a light colour throughout; paralysis of the posterior limbs ensues, and the animal perishes.

In less rapid cases, however, the symptoms are not nearly so numerous nor so urgent at first; and they may remain stationary for twelve, twenty-four, or even forty-eight hours, particularly if the eruption has not appeared. At the end of this period they become greatly intensified, and the ears and skin are

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tatus—first described as affecting pigs in Brazil, and stated by Dr. Cobbold, in 1871, to affect pigs in America and Australia. It is chiefly found in the fat of the animal, and appears to be at first free, then encysted. The size of the cyst is unusually large—one inch and three-quarters long, and half an inch in diameter; the fully developed parasite being one and a half inches in length. The cyst contains three to six eggs, and the young worms are migratory. There is nothing to show that this parasite is the cause of the above disease.

very hot, the surface of the body, and especially the lower part of the belly, being extremely sensitive to pressure; the animal expresses the pain it experiences by plaintive cries, especially when made to move; and there are tremblings, convulsions, and grinding of the teeth, the flexor muscles of the limbs contracting in such a spasmodic manner that the creature is compelled to stand on the points of its hoofs. The temperature falls; the body is cold, and the eye dull and muco-purulent; the conjunctival membrane being brown-coloured, and the tongue foul and of a bluish hue. There is either obstinate constipation, or a fœtid sero-sanguinolent diarrhœa; the urine is scanty and red; the pulse is imperceptible, and the heart-beats feeble, until at last they cannot be heard; the respiration is laborious, and the skin insensible.

In the meantime, the characteristic and distinctive eruption has appeared, and this deserves some notice. The patches of ecchymoses which pass for an eruption, are noticed when the disease has nearly reached its full development. They usually commence by a more or less deep redness of the skin in patches of unequal size, which looks as if marbled; they are more particularly noticed on the ears, upper, and anterior part of the neck, lower part of the belly, inner surface of the limbs, and those parts where the skin is thin, and especially in white pigs. At first, when these spots are merely due to congestion of the vessels, the colour disappears on slight pressure being made; but when the blood has become effused, this change can no longer be produced. Very soon there appears on this coloured surface deeper-red, brown, violet, purple, or wine-coloured spots, round or irregular in shape. They increase in extent and become confluent, or remain discrete, according to the severity of the attack. Their persistence and extension are always a reliable indication of approaching death. In favourable cases, when the other symptoms are less severe and begin to abate, they become pale and disappear with the disease; but when the malady runs its course rapidly, which is generally the case, they increase in size and pass into each other, forming a continuous erysipelatous swelling, until nearly the whole surface of the body is marbled with black, white,

yellow, purple, and blue-black. Sometimes the discolouration is covered with a vesicular eruption; at other times a cold serosity exudes from the surface; the bristles and epidermis are detached, gangrene has set in, and the integument has lost its sensibility. In some animals sloughing occurs at these places, and extensive ulcerations remain.

The discoloured patches, as has been remarked, represent the Anthrax tumours of the other domesticated animals; and, indeed, it is sometimes observed that they become concentrated, as it were, on the ears, limbs, or tail of the hog, forming circumscribed serous tumours in these regions. Mortification in these cases will cause the loss of the tail, ears, and extremity of the limbs. When the tumours are being developed, there is often a notable amelioration in the symptoms, and at times recovery takes place after they have sloughed.

When death is imminent, the animal lies extended motionless on the litter, except at intervals, when there are sudden and severe convulsions; paralysis of the posterior extremities is very noticeable; the visible mucous membranes have a most repulsive appearance, the cries are more pitiful, the fæces are passed involuntarily, the respiration is spasmodic, and the creature finally succumbs in six or twelve hours, or more frequently in from two to four days.

Of those which recover at a comparatively late period, some remain paralyzed and are difficult to fatten, while others thrive well afterwards. Where the spots were, the epidermis desquamates and the bristles are shed.*

* The highest veterinary authorities are not altogether agreed as to whether this disease of pigs is really of an Anthracoid nature. I have followed Röll, Reynal, and other distinguished veterinarians, in placing it here; but Zundel and other equally reliable writers deny that it has any affinity to Anthrax, inasmuch as the blood does not present the same alterations as in that disease, but is red and rich in fibrine, and does not contain *bacteridia*. The other essential pathological alterations are also modified or absent, and the malady is not contagious. But it must be remarked that the malady has been recognized as contagious in this and other countries, and that Carsten Harms has found in the blood and other tissues a vegetable parasite not very dissimilar to that observed in Anthrax. It is not at all improbable that more than one disease of the pig is confounded with this. Epizoötic erysipelas has been designated by the

Anthracoid Angina.

This variety of Anthrax frequently complicates the last, and is characterized by the formation of tumours on the neck and in the region of the pharynx. There is intense fever; the respiration rapidly becomes difficult, gasping, and stridulous, while the groaning is husky. The snout is dry and very hot, the tongue swollen, and the buccal membrane of a reddish-brown colour; and dysphagia and a disposition to vomit are manifested. Around the larynx and along the trachea appears a hard, hot, and painful swelling, which frequently extends to the fore limbs and lower part of the chest; it is frequently at first of a leaden colour, but finally becomes purple, and acquires an œdematous aspect. The constitutional disturbance is generally very considerable; breathing is most difficult, and the mouth is widely opened; the animal sits on its hind quarters, or remains lying; the membrane of the mouth and the snout become of a leaden hue; the body becomes cold; the saliva is abundant, fœtid, and sanguinolent; the back of the throat is swollen and livid; the tissues about the neck crepitate on pressure; and a fatal result occurs from asphyxia, or the result of gangrene in the parts indicated, in one or two days. Recovery, which is rare, is marked by the respiration becoming easier, the difficulty in swallowing is diminished, and the swelling does not increase, or gradually subsides.

This form of Anthrax, as well as the others, is developed spontaneously, or in consequence of eating Anthrax flesh, blood, &c.*

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same name, and it appears certain that Zundel, Harms, and others have been so designating this cutaneous affection, which is essentially an inflammatory congestion. Pigs which die of heat Apoplexy also present similar symptoms.

* This variety of Anthrax is frequently observed in the other domesticated animals, and especially the horse. A large number of outbreaks are mentioned in "Animal Plagues," and particularly one in 1777, among the horses of a cavalry regiment at Dora, near Turin.

SYMPTOMS OF ANTHRAX IN THE DOG AND CAT.

The spontaneous development of Anthrax has not been observed in these animals, but it is frequently transmitted to them by inoculation, or through devouring the flesh or blood of other creatures which have been affected. The malady manifests itself in them in its various forms—the apoplectic, febrile, carbuncular, and erysipelatous (the two latter at the head and neck more particularly), as well as in the form of pustules in the mouth. The local manifestations are, in fact, developed at the parts most exposed to contact with the virulent principle.*

* When a person is inoculated with the Anthrax poison, and malignant pustule is about to appear, an intolerable itching usually commences at the spot, which compels the patient to rub and scratch it violently. In a short time there is seen a small umbilicated vesicle about the size of a pin head or a grain of millet, and containing a drop of citron or reddish-coloured serum. This vesicle is soon ruptured through the rubbing occasioned by the itching, and the skin beneath, especially in the centre, at first yellow, becomes brown, then black, hard, and coriaceous. Very soon there appear other vesicles that form a more or less regular circle round the remains of the first, but there is no pain felt on pressure or manipulation of the parts. The subcutaneous connective tissue becomes puffy, and rather elastic than œdematous. The centre of the little tumour is completely bloodless, while the subjacent tissues are so highly vascular that, if punctured or cut into, the hæmorrhage is relatively considerable, and nearly always continues for a long time.

The elastic swelling goes on increasing, symptoms of general disturbance are added to the local phenomena, and Anthracoid intoxication rapidly becomes apparent. The patient has fainting fits; the pulse is weak and irregular; bilious matters are vomited in abundance; cold sweats appear; and in about an average of four, five, six, or seven days he dies asphyxiated, unless energetic treatment is adopted in time. The treatment consists essentially in deep and thorough cauterization of the carbuncle.

Such is the transmitted malignant pustule of the human species, varying only slightly in its appearance and development according to the region of the body in which it appears. It is often confounded with the benignant carbuncle, which is not transmitted, and which appears spontaneously. The malignant pustule is inoculable from man to the horse, rabbit, guinea-

The dog appears to be much less susceptible to the action of the contagium than most other creatures, and it would seem that it is only liable to become infected through direct inoculation, or when it has devoured the flesh of animals which have perished from the disease. After eating this poisonous flesh, its bite has been known to produce Anthrax in sheep and swine, without itself becoming affected; and the milder forms of the malady are as amenable to treatment in this as in other animals.

Nevertheless, through some special morbid susceptibility, or a more than ordinary virulency of the contagium, dogs become infected, sicken, and not unfrequently die very suddenly. The flesh of one dead animal has been known to cause the disease in several dogs, and even packs of hounds have been so infected. Dogs eating diseased flesh, and biting each other, will, of course, produce the malady by inoculation. Numerous instances are recorded in continental veterinary literature, in which dogs so infected have perished quickly, and have offered but few traces of disease.* Grève, Gerlach, and Haubner give some striking examples. Lüpke mentions an instance in which a dog became infected by eating the blood of an animal that died of Anthrax fever, and an hour afterwards he found it lying on the straw vomiting; in seven hours it perished in convulsions. On examining its body, he found his conjectures verified as to the nature of the disease; the spleen was greatly

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pig, sheep, &c.; the benignant or spontaneous carbuncle is not so. So that all tumours of this description, which are not inoculable from man to the lower animals, ought not to be regarded as the malignant pustule we are now describing. Other considerations should also serve as a guide in distinguishing them. For instance, malignant pustule is seen in the regions where Anthrax prevails in animals, and, like that malady, it is rare in towns, but frequent in the country; it attacks people, who, from their avocations, have more or less direct relations with animals or their products—such as shepherds, cowherds, farm labourers, tanners, knackers, butchers, and veterinary surgeons; that it exclusively attacks the uncovered parts of the body, as the hands, neck, face, &c., and that simple local treatment will disperse it and save the patient.

* A number of these are described in "Animal Plagues."

enlarged and dark-coloured, the stomach empty and inflamed, and the blood-vessels distended with black treacly blood.

In another instance, a dog ate a portion of the intestines of a goat that had suffered from Anthrax before it was killed. Within two hours it was attacked with urgent symptoms of Colic, vomited the remains of the food, which were mixed with black blood, had sanguinolent Diarrhœa, and in ten hours after eating the goat's intestines it died. On examination, its body exhibited all the alterations noted in carbuncular disease of the intestines, even to the presence of the yellow exudat in the mesenteric glands.

Mouth-anthrax has also been observed in the dog through infection. Among others, Vix has given us instances. This veterinarian particularly refers to his having made a necroscopical examination of an ox that had died of splenic Apoplexy, when his dog licked up some of the effused blood that lay on the ground. In twelve hours there were Anthrax vesicles (*brand blasen*) in its mouth, and its head became so swollen that it was with great difficulty he saved the life of the animal.

Other instances have been given of throat Anthrax or anthracoid Angina. Gerlach gives an account of a deer-hound that ate the flesh of a sheep which had died from Anthrax fever. Soon after it became sick, its throat swelled, and with careful treatment it was some days before recovery took place.

The disease also attacks the head, and Wirtzen mentions an outbreak of this kind among a herd of swine and two dogs, through their being fed with the flesh of a diseased ox. Walch also alludes to a case of a shepherd's dog that was affected in this way, and had a large carbuncle on its back, due to having fed on a piece of diseased sheep.

But the most remarkable instance, perhaps, is that recorded by Rougieux as occurring among a lot of English hounds, one hundred and fifty in number, forming the pack of Baron von Schikler, at Morfontaine, near Paris, in 1827. Through the carelessness of those in charge of this pack, the flesh of a

horse that had died of Anthrax was given them all, except four or five, to eat. On the following day, the disease appeared; in four days, a hundred were attacked; and on the arrival of the veterinary surgeon twenty had succumbed, and forty were in a hopeless condition. The remainder were in the early stages of the malady.

"When the disease first showed itself, there was observed, as a precursory sign, swelling of the parotid glands; then a small round tumour—but without any change in the colour of the skin, increase of temperature, or increased sensibility—formed on some part of the head—usually about the lips, forehead, parotideal region, or lower jaw, and sometimes, though rarely, on the body or limbs, accompanied by tension of the skin. In a few hours, this tumour acquired a considerable development: occupying all the region in which it was situated, when it appeared on the head, and giving the animal a hideous appearance; the swelling completely closed the eyes, extended down the neck along the trachea, and rendered the respiration so difficult and stertorous as to induce prompt suffocation. When the tumour had acquired considerable dimensions, the skin covering it showed numerous circular ecchymotic spots of various sizes, of a reddish-violet colour, and a gangrenous appearance, the largest of which corresponded to the point wherein the swelling had first appeared. In a short time, all the skin of the swollen part assumed this hue; the membrane lining the mouth also showed the same tint, and a large quantity of viscid saliva flowed from this aperture. There was no appetite, fæces were rarely passed, and were mixed with blood. The animals lay continuously, in a state of great prostration, and insensible to the call of those persons who attended to them; they preferred cold, damp places in their kennel, to the excellent bed of straw prepared for them. . . . The symptoms succeeded each other in some cases with terrible rapidity. In the morning, for instance, a small tumour would appear on the head, and in the evening the swelling of this part had attained its extreme dimensions. This state would continue until the next day; then the suffocative *râle* was heard, and this was the prelude to death in the majority of cases, if curative mea-

sures were not adopted promptly. The duration of the disease, whether the issue was favourable or unfavourable, was not beyond five days. Death often occurred on the third day, and recovery about the same interval."

SYMPTOMS OF ANTHRAX IN POULTRY.

Poultry are frequently observed to die suddenly during the prevalence of Anthrax among mammals, probably from their having ingested some portion of these. Fowls, geese, ducks, turkeys, pigeons, &c., have at various times been so involved; and epizoöties, even, have been recorded. Death nearly always occurs before the early symptoms have been noted; but in those fowls which have been carefully watched, there has been remarked a loss of appetite, with prostration: indicated by bristling of the feathers, drooping wings, and difficulty in walking. The birds lie huddled up in a corner, without attempting to go on their perch (if they are perching creatures), and there is a greatly exaggerated sensibility of the limbs and spine. A fœtid Diarrhœa soon sets in; the beak and crest (if there be one) become black; grayish-blue tumours, or dark patches, appear on the body, in the mouth, between the toes, and on the web (if the bird is a palmiped); gangrene promptly attacks these parts, and there is a peculiar turgesence of the conjunctival membrane; the feathers fall off, convulsive tremblings ensue, and a severe Diarrhœa continues until the creature succumbs, which is generally in a few hours.*

COURSE AND TERMINATIONS OF ANTHRAX.

The course and termination of the various forms of Anthrax have already been sufficiently described in the symptomatology. Some of the varieties are greatly more rapid and fatal than others, death occurring almost imme-

* I have made no allusion to Anthrax as it appears in fishes. Several very interesting accounts of wide-spread and destructive outbreaks among the finny denizens of rivers, lakes, ponds, and the sea, are given in "Animal Plagues." Others will be alluded to in another volume of that work, which is being prepared for the press.

diately. These are the apoplectic and febrile varieties. In the horse, and particularly at the commencement of an epizoöty, the first-named may destroy the animal in a few minutes, without any warning; while the fever may kill in twelve to twenty-four hours. The so-called "typhus" of the horse is very acute, and death occurs in a few days, after violent attacks of what appears to be Colic. Or it may extend to one or more weeks, and even months, in less acute cases, when convalescence is long. In cattle, sheep, and pigs, the course and termination is similar; and it may be said that, as a rule, Anthrax is one of the most rapid and fatal maladies to which the lower animals are liable.

PATHOLOGICAL ANATOMY.

A peculiar feature of anthracoid maladies is their tendency to putrefaction, even before life is extinct; and the characteristic signs of that process are very marked after death, and become exaggerated with remarkable rapidity, especially if the weather is hot. The subcutaneous connective tissue is in parts distended with gas—the result of putrefaction—while the animal is alive; and immediately after death, the body becomes immensely swollen and deformed; when the skin is incised, or the abdomen opened, the gas escapes with a hissing or crackling sound, has a foul smell, and is accompanied by gushes of black fluid blood.

The *rigor mortis* is always slight, and usually a bloody fluid escapes from the natural openings. The rectum and vagina are deep red, or nearly black, and in the majority of cases greatly everted. The skin is discoloured in places, as if there had been contusions during life, and the hairs come off with the least traction. Where tumours have formed, it is detached by the slightest pull, and its inner surface is observed to be studded with dark-red or black patches. At these places it is thin and broken, and without consistency when tanned.

Yellow or dark-coloured infiltrations of serum appear everywhere in the connective tissue, and particularly between the muscles, whose texture is of a dark-red, violet, or black tint, impregnated with black blood, soft, friable, and easily reduced

to a pulp. These alterations are most noticeable in the regions where tumours have formed. The tumours themselves are composed of a collection of gelatinous, citron-coloured matter, which infiltrates the subcutaneous connective and intermuscular textures, penetrating deeply, and destroying the tissues; this serosity escapes in a bubbling or foamy manner, and has a most disagreeable odour. Decomposition may be well advanced in some parts.

Every part of the body in contact with the black, tarry-looking fluid blood, is stained a reddish-brown colour, which penetrates to a considerable depth, and cannot be removed by washing. The veins and large blood-vessels are filled with this blood, and their lining membrane, as well as that of the heart, is so coloured. The heart is soft and flaccid, and covered with black patches, which often extend throughout its texture; the pericardium frequently contains an unusually large quantity of coloured serum. The lymphatic glands are enlarged and infiltrated, often ecchymosed, and always surrounded with a citrine-coloured or sanguinolent mass similar to that composing the tumours. The lymphatic vessels, and especially those proceeding from the region of the tumours, are filled with reddish lymph, which, however, contains no pus globules.

The abdominal cavity ordinarily contains a quantity of dark yellow, often blood-coloured fluid; and in the duplicatures of the peritoneum—in the mesentery particularly—there are infiltrations quite like those of the tumours, as well as soft masses of dark blood in the sublumbar region, but chiefly surrounding the kidneys, the lymphatic glands in their vicinity, pancreas, and posterior vena cava. The intestines are red-coloured, externally and internally, for the greater part of their extent; and the substance of the mucous membrane is infiltrated with blood, as if intensely congested.

The spleen offers, it might be said, the most characteristic and constant pathological feature of the disease. Its colour is a livid hue, or black; its volume is oftentimes enormous, and it is four or five times its normal weight; while its surface may be even, or irregularly studded with tumours. Not unfrequently it is ruptured, from over distension of its envelope in

more than one place where these prominences are; and from the openings, or from incisions purposely made, flows a black fluid blood, not unlike dissolved China ink. Its structure is converted into a corrupt fluid mass, and putrefaction sets in very quickly in this organ; it is not unfrequently emphysematous, especially when the capsule is not ruptured.

The liver is also enlarged, from the accumulation of fluid blood (less tarry-looking than in the spleen) in its interior; it looks as if it were cooked, and its texture is so friable that it is readily broken up by slight pressure. The kidneys are in the same condition, as are also the lungs. The bladder is marked by ecchymosed patches.

The lungs are voluminous, darkly congested, and crepitate loudly; the pleural cavity contains a fluid similar to that in the abdomen, the pleura itself being stained with extravasations of dark blood; the subserous connective tissue, especially that between the lungs and around the large vessels, is infiltrated with the yellow gelatinous fluid, and blood extravasations are numerous here, as well as in the bronchial mucous membrane and elsewhere. They are conspicuous in the different parts of the nervous system: in the nervous tissue as in the envelopes.

These extravasations, and the yellow, brown, or blood-stained infiltrations found everywhere throughout the body, together with the tendency to rapid putrefaction, constitute a very conspicuous and remarkable feature of Anthrax.

We have already alluded to the physical appearance of the blood and its very striking alterations. It is black, and has lost its customary fluidity; and during life its temperature descends as the disease advances, Reynal having observed it at 37° Cent. (98.6° Fahr., the natural temperature being about 99.5° for the horse and 100.4° to 101° for the ox). Its density is increased, and varies from 1.050 to 1.064, while in health it has an average of 1.046; this alteration in the density of Anthrax blood has been also observed in that of animals which have perished from traumatic gangrene. The Anthrax blood has also a peculiar odour, similar to that given off from the sphacelous Anthrax carbuncle.

There is a most notable diminution in the proportion of fibrine; indeed, this has almost disappeared, and there have been only found a few slender soft filaments in two décilitres (1.409 gills); while in the healthy horse, the same quantity yielded four grammes (1.129 drams) of moist, and one gramme (0.564 grains) of dried fibrine. The quantities are a trifle larger in the ox. The Anthrax blood does not, therefore, coagulate, but remains fluid or semifluid. In the horse its constituents segregate slowly and imperfectly; and in the majority of cases the clot has become liquefied before the serous portion has had time to separate, even with the greatest care. This serum has a yellow or brown tint, being sometimes like a weak decoction of coffee. In the ox the blood at times appears as a thin jelly; but in the great majority of serious cases it does not coagulate in the slightest degree, and putrefies with a marvellous rapidity.

It has been shown that there is really no chemical difference between Anthrax blood and that which, obtained from a healthy animal, has commenced to putrefy. The albumen in both, according to Sanson, is converted into diastase, and rapidly induces the transformation of amidon into dextrine and glycose; and the serum of putrefying blood, like Anthrax blood, has become osmotic—passing readily through animal membranes.

The globules are most frequently destitute of contents, and are altered in outline, being generally stellate. This alteration is only observed at an advanced stage of the disease, and is not seen in putrefying blood until it has attained a high degree of putridity.

The blood of animals affected with Anthrax is, therefore, characterized by a notable diminution in the proportion of fibrine—two-thirds at least—and this accounts for its loss of coagulability; by its incapability of reddening on exposure to the atmosphere; and by the promptness with which it putrefies, as is evidenced by its tarry consistency, its black colour, its odour, and the facility with which it deeply and permanently stains the animal tissues. These characteristics are all the more marked as the disease is intense and its course rapid.

Another characteristic of this fluid in this and other septicæmic affections, is the presence of the innumerable "bacteria," or "bacteridia," already mentioned, and which were first observed by Brauell, the talented veterinary professor of Dorpat, and afterwards by the French veterinarian, Delafond (who designated them "bâtonnets") in the blood of animals affected with Anthrax.

We cannot now enter into the discussion as to whether these minute bodies are really the cause or the result of the disease. We can only say that the question is still in dispute. Numerous opinions have been given as to their nature. Brauell and Fuchs considered them to be vibriones; Virchow, Leisering, Müller, and others, believed them to be crystals; while Bruckmüller thought they were coagulated fibrine. Davaine, who has perhaps studied them most attentively, was at first of opinion that they were the same as the bacteria which appear in vegetable infusions; but he afterwards designated them "bacteridia," because they did not offer the mobility of these. Sanson has, however, endeavoured to show that their power of movement depends upon the consistency of the medium in which they are observed, and not on their species, as they—the non-mobile bacteria—become active when water is added. Other authorities, however, assert that, at the temperature of the body, these bacteridia possess a very slight forward and lateral motion of their hinder part, but that at a temperature of 15° Centigrade they become immovable.

It may be remarked that, according to Bender and Semmer, the *bacteridia* of Anthrax are distinguishable from those of Septicæmia by their being about one-third less in size, possessing a greater homogeneity of structure, and refracting the light more highly. Rawitsch, of St. Petersburg, and Sanson, however, deny this difference.

But it is to be remarked that these bacteridia are constantly present in those diseases which have any analogy to anthracoid affections. Some high authorities have, therefore, concluded that they are a consequence of the characteristic alteration that occurs in these maladies, or of putrefaction; and that the latter may exist, and cause death, before the presence of

these microcosms is manifest. Others consider them the cause of the disease, and as diagnostic of its existence, even during life; but Sanson, in his researches and experiments in a serious form of Anthrax which prevails in Auvergne, France, and which is popularly known as the *Mal de Montagne*, would have us conclude that the blood may possess virulent properties without these bacteridia being discoverable in it. Others, again, assert that if they are also met with in putrefying blood obtained from animals which were not affected with Anthrax, this only proves that blood in a state of putrefaction presents the conditions necessary for their production—conditions which are already in existence in Anthrax during the life of the sick animal.

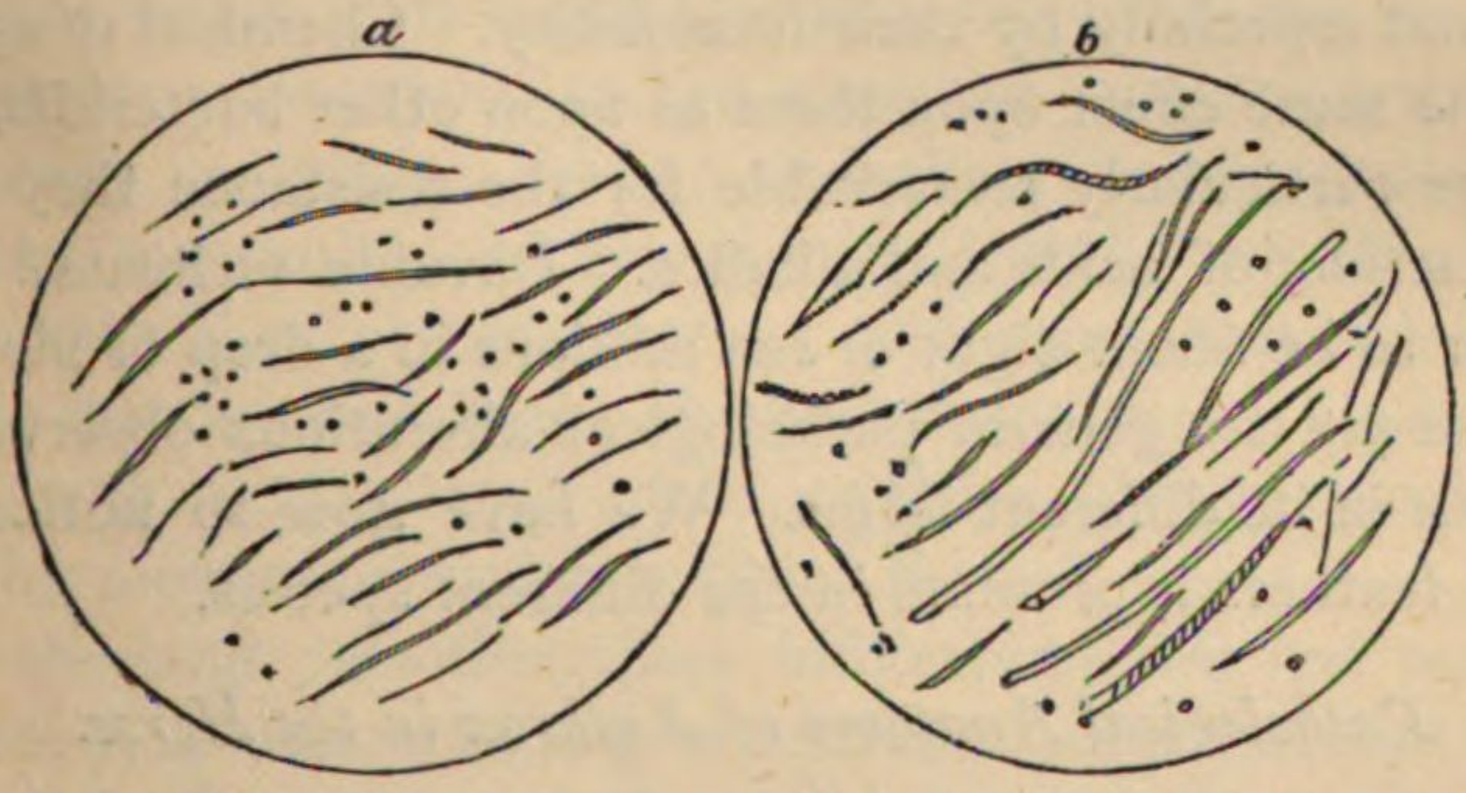
It has been shown that the bacteridia are constantly present in rodents, such as the rabbit and Guinea-pig, when inoculated with septicæmic fluid; but Sanson did not find this to be the case in the large and small ruminants on which he experimented. It is quite possible, however, that, owing to their extreme minuteness, even when fully developed, they may enter the blood, and exist in it for some time, of such diminutive dimensions as to be indistinguishable by the microscope; for it would appear that, as simple cells, or as the most minute and somewhat bright points—in fact, as pseudo-vibriones—they are capable, in every instance, of inducing changes in the blood.

As we have said before, in whichever way the discussion may terminate, this much at present is certain—that if these minute organisms are not an essential element in the pathological anatomy of Anthrax, they nevertheless constitute one of its most important characteristics.

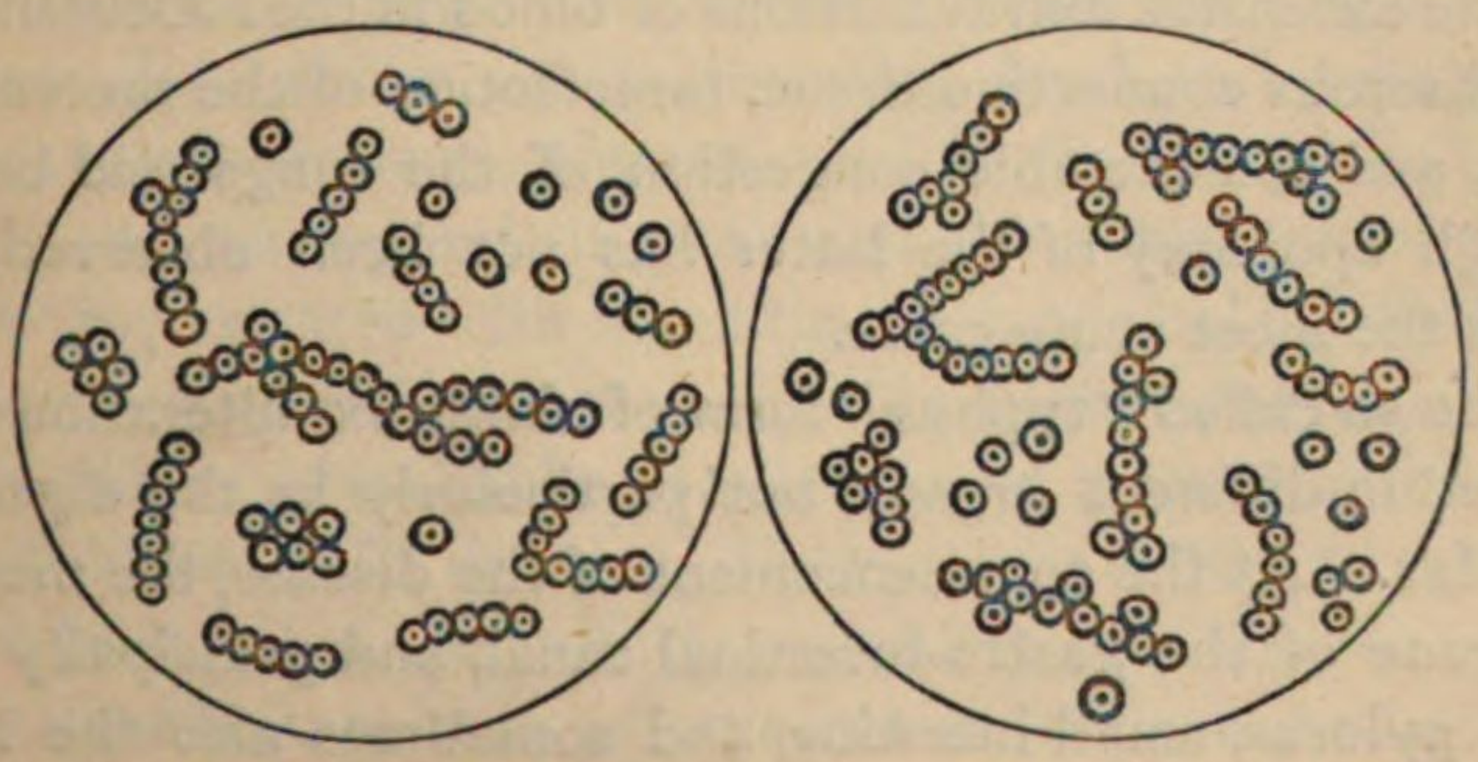
We have already alluded briefly to their general features. They are somewhat differently delineated by observers, as the accompanying figures will show. According to Hallier, Robin, Franck, Böllinger, and others, they are only the fragments of some leptothrix, and do not differ in any of the forms of Anthrax. Böllinger describes them, as found in the blood of living or dead animals affected with Anthrax, as straight, cylindrical, rarely bent, and very pale and immovable bodies,

Bacteridia in a drop of serum of Anthrax blood.

Bacteridia of Anthrax: portion of clot.



Bacteridia: after Semmer—*a*, of Anthrax; *b*, Septicæmia.



Bacteridia of Anthrax: after Böllinger. Magnified 550 diameters.

of great minuteness, and so slender that they cannot be measured. When in a fresh condition, and moderately magnified, they appear to be non-articulated and homogeneous; but when highly magnified and distended with water, they are then observed to be composed of round or slightly elongated cells, placed end to end, to form chaplets. Sometimes, however, they are isolated, and they then constitute the germs of bacteridia. These cells constantly multiply by segmentation, joining end to end during the process. When distended, it is seen that these cells have a wall, and a distinct cavity containing plasm. The bacteridia belonging to this group partake more of the character of vegetable than animal organisms. According to this authority, the Bacteridia in Anthrax blood are particularly distinguished from those of putrefaction or Septicæmia, or those of sour milk, by a certain symmetry of form, and especially by their immobility. Chemical re-agents have the same effect upon them as upon other bacteridia, and they are particularly remarkable for the resistance they offer to the action of acids and alkalies. Davaine estimated their number to be about eight or ten millions in a drop of blood.

These are the general pathological alterations observed in Anthrax in its different forms. We have now to notice the special features it presents in the different species.

Pathological Anatomy of Anthrax in the Horse.

In non-localized Anthrax of the horse, besides the alterations in the blood and the splenic enlargement already noted, there are extensive extravasations of blood in the subcutaneous and subserous connective tissue, tumefaction of the mesenteric glands, and considerable congestion of the lungs and brain; although apoplexy of the latter has not been observed, not even in the most acute cases.

In the so-called "typhus" form of Anthrax, alterations are observed in different organs, but particularly in the digestive apparatus. At the commencement of the disease, the mucous membrane of the gastro-intestinal canal, and principally that of the pylorus, small intestine, and sometimes also the large intestine, is much thickened and softened, its colour deeper,

and its surface is more or less closely studded with points of extravasation; in the small intestine, the villi are swollen and erect; and the submucous connective tissue is impregnated with a muddy, gelatinous fluid, traversed by numerous blood-vessels, and gorged with blood. In rare cases, Peyer's patches are salient, appearing as highly-coloured, swollen, areolated masses. At a later period, there are numerous infiltrations in the form of rounded prominences, which are most frequently observed on the mucous membrane of the pyloric portion of the stomach, the duodenum, cæcum, and colon. In the two first, there are most frequently irregularly disposed parts of the membrane, from half an inch to two inches, or more, in diameter, which are tumefied, very soft, project some lines above the adjoining surface, are of a deep reddish-blue colour, and infiltrated with a tenacious or gelatinous mass of a dark-blue tint, which is traversed by stripes of yellow exudat. This infiltration may extend to the muscular layer, or even to the subserous connective tissue; and these lesions, variable in number, may unite, and give rise to diversely-shaped patches; sometimes they are so close to each other, that the surface of the mucous membrane involved resembles a great vesicle filled with extravasated blood, or there scarcely remains any healthy membrane visible between them.

In the large intestine, these infiltrations are not nearly so extensive, seldom attaining more than from a few lines to half an inch in diameter; but the adjoining mucous membrane is swollen, and of a deep-red colour. It is only in exceptional cases that Peyer's patches are tumefied to the extent of one or two lines above the surrounding level, and traversed by blood extravasations; the various follicles being filled with a gray, firm, muco-purulent mass, and the subjacent connective tissue impregnated with a gelatinous, sanguinolent fluid.

A yellow, viscid, mucous secretion covers the membrane; and in the intestinal tube is often found a considerable quantity of black fluid, or very slightly coagulated blood. The violet colour, and the injection presented by the serous tunic of the intestine, reveals externally the infiltrations and extravasations which have occurred in its interior.

In many cases the infiltrated matters appear to have been absorbed, leaving behind them a very high-coloured state of the membrane. This appearance is met with in those animals in which, during life, swellings of the skin and Colic have frequently alternated. In the majority of instances, the infiltrated parts slough away in the form of an eschar, which is at first moist and of a deep-yellow colour, but soon dies, and begins to be detached from the circumference towards the centre. In shape, these eschars of course correspond to the infiltrated part; they are irregular and very extensive in the stomach and duodenum; but somewhat circular and small, though generally close together, in one part or other of the cæcum and colon. The adjacent membrane is greatly tumefied, impregnated with a grumous fluid, and gray or violet in colour. The stomach and intestines are distended by gas; the *glandulæ agminatæ* are tumefied; and the other parts of the mucous membrane are usually pale, and coloured here and there by a grayish pigment. The intestine contains a quantity of a foul-smelling, grayish-red fluid.

When the eschars are shed, various-sized, unhealthy-looking ulcers remain; these are irregular or elongated in the stomach and duodenum, and circular in the large intestine; their margin in the two first portions of the intestines are always ragged; but in the large intestine they look as if cut by a stamp, though there is always a large amount of tumefaction, and the colour is a slate-gray, or even bluish, from the presence of pigment or blood in a state of change. The bottom of the ulcer is, as a rule, formed by the submucous connective tissue, or the softened muscular layer, both being rich in this pigmentary matter. If the ulcers have a tendency to heal, their borders contract a little, and unite with the bottom of the cavity, from which granulations spring up; while the loss of substance is otherwise gradually repaired by the connective tissue. The process of recovery has, however, only been followed up to the present time in small ulcers; as it appears that, in general, the affected animal only lives when the absorption of the exudats deposited on the mucous membrane occurs, and when the ulcers that may form are of small dimensions. Röll, who ap-

pears to have made a special study of the disease, states that, in examining a horse which has perished from it, he has never observed any attempts at repair in a large ulcer; and if such an event did occur, there should be at least found some trace of a callous cicatrix.

It is not rare to discover the different stages of this "typhic" process in the different parts of the digestive canal of the same animal. Analogous alterations are met with in the nasal mucous membrane, and the tumefactions of the skin and infiltrations of the connective tissue beneath it are similar in character to those already mentioned. The diseased parts have frequently a thickness of two, four, or more inches, and the connective tissue of the skin and muscles is infiltrated with the yellow exudations streaked with blood, which are so characteristic of Anthrax. There are also sometimes observed masses of coagulated fibrine, and mortified connective and tendinous tissue, in cavities beneath the skin, and which also contain a sanious fluid that communicates a sensation of burning to the skin of the dissector. The muscles offer the changes already alluded to, but the hæmorrhagic patches are most frequently observed in the left ventricle of the heart, particularly towards the insertion of the *columnæ carneæ*. In these cases the endocardium is raised by the extravasated blood, and forms vesicles as large as a hemp-seed or pea, or diffused patches: the muscular tissue beneath being deeply impregnated, or completely destroyed. These extravasations are also frequent in the masseter and temporal muscles, as well as in the lateral muscles of the neck. Hæmorrhagic effusion may also occur in the muscles of the eye, or in that organ itself, in which case its internal structure is destroyed. The same effusions and gelatinous exudats occur in the mucous membrane of the larynx, and chiefly about the epiglottis, vocal cords, and arytenoïdes, as well as in the pharynx and trachea.

The spleen is double and treble its ordinary volume; its surface is sometimes bosselated by tumours; its texture is softened and transformed into a viscid reddish-brown or violet mass, and the meseraic glands are infiltrated. The blood in it has been found to contain bacteridia when examined soon after death.

These are the most constant lesions found in this equine form of Anthrax.

The affections which most frequently accompany or complicate the disease, are inflammation of the lungs terminating in gangrene, or acute œdema of these organs. One or other of these is most frequently the immediate cause of death, when the morbid process does not more particularly localize itself in the intestines. Œdema of the glottis is a less frequent complication. Hæmorrhage in the subpleural tissue and the adipose capsule of the kidneys, as well as infiltration of the bronchial glands, are frequent.

Pathological Anatomy of Anthrax in the Ox.

In the Anthrax fever or splenic Apoplexy form, the necroscopical appearances already noted are observed. In certain of the less acute cases, tumefaction and infiltration, and even ulceration of Peyer's patches, have been noted.

In "glossanthrax," in addition to the alterations in the mouth, the other characteristic changes already indicated are observed.

In the form of Anthrax which is more particularly marked by the development of anthracoid tumours in the rectum, besides the other characteristic lesions, there are found gelatinous infiltrations between the tunics of this portion of the intestine, and gangrenous destruction of its mucous membrane.

Carbuncular Anthrax also shows the same general alterations as the other forms.

Pathological Anatomy of Anthrax in Sheep.

In the anthracoid Erysipelas of sheep the ordinary lesions are likewise witnessed, with gangrenous destruction of the skin, subcutaneous connective tissue, and the adjoining muscles, and yellow gelatinous exudations.

Pathological Anatomy of Anthrax in the Pig.

In this animal, we find lesions in the different forms of the disease similar to those already enumerated.

The Anthrax fever of this animal closely resembles the Typhus fever of the horse, so far as the alterations in the intestines are concerned. The glands of this part are affected

in an analogous manner, becoming ulcerated, covered with sloughs, and infiltrations and exudats in some cases; in others, the extravasations of blood are more noticeable.

Pathological Anatomy of Anthrax in the Dog.

The alterations observed in the body of this animal are analogous to those already noted. In the outbreak among the hounds, witnessed by Rougieux, and already alluded to when describing the symptoms of Anthrax in the dog, an examination of a large number immediately after death, in consequence of the rapidity with which putrefaction set in, proved the lesions to be the same in all the animals. The black patches on the skin were coincident with infiltration of the subjacent connective tissue, by a considerable quantity of yellow fluid which extended beneath it, and, in fact, constituted the swellings; it also occupied the muscular interstices. When the disease occupied the head, this infiltration extended to the lower jaw, the laryngeal region, neck and trachea; while the parotid glands were frequently of considerable size, infiltrated with reddish serum, their connective tissue congested, and here and there discoloured by ecchymoses. The blood contained in the heart and large vessels was very black and pitch-like. The heart and lungs did not offer any remarkable alteration. In some of the animals the mucous membrane of the small intestines was of a red colour, from extravasation of blood.

In the other mammals the necroscopical lesions are similar.

Pathological Anatomy of Anthrax in Birds.

In these creatures the blood possesses the same characteristics as in mammals; there are congestions of the muscular tissue, lungs, liver, and spleen, as well as hæmorrhagic extravasations into the texture of the digestive mucous membrane and the oviduct; sometimes there are gelatinous exudations into the connective tissue of the skin and mucous membranes.

DIAGNOSIS.

An attentive study of the symptomatology and the pathological anatomy of Anthrax, should enable the expert to distinguish this from other diseases. The yellow or brown

gelatinous exudations and infiltrations; the peculiar appearance of the blood, and the presence in it of *bacteridia;* as well as the contagious character of the malady; should go far to establish a distinction. The history of the outbreak should also be taken into account. The probable causes of the disease, the influence of the locality, if other cases have appeared in the district, and under what circumstances, and if infection can be traced, should always be made subjects of inquiry. In doubtful cases inoculation may be resorted to. A rabbit, guinea-pig, or any other small animal, readily susceptible to the influence of the virus, may be made the subject of experiment. This is an excellent and a certain test.

CONTAGIUM.

We know but little of the nature of the infective principle for certain, except that recent experiments seem to show that, like the virus of Variola, Cattle-plague, and some other contagious maladies, it is not diffusible in water. There appear to be no good reasons for doubting that the bacteridia are really the active agents in producing the malady; and the parasitic nature of the affection appears to be proved, independently of the experimental and anatomo-pathological observations already accumulated, by the fact that the anatomical alterations and clinical phenomena that characterize it in the domesticated animals, and particularly when it appears in the apoplectic and acute forms, are explained by the physiological effects and properties of these bacteridia. According to Zundel, the effect of these in the living body consists essentially in the great affinity they have for oxygen, which they rapidly absorb in large quantities; thus depriving the red globules of one of their most important elements. In consequence of this action—which, owing to the immense number of these organisms, is considerable—there is soon a scarcity of oxygen, and an abnormal amount of carbonic acid. To this circumstance is due the symptoms of dyspnœa, cyanosis, the clonic convulsions, dilatation of the pupil, lowering of the temperature, and, finally, asphyxia. For this reason, also, it is that we find at the autopsy of an animal which has

perished from Anthrax all the appearances noted in creatures which had died from poisoning with carbonic acid.

Another fact adduced to prove the parasitic nature of Anthrax is to the effect, that inoculation with the blood of a fœtus from the uterus of a diseased animal has never been successful: the bacteridia of the mother's blood not passing through the placenta, which thus acts as a physiological filter. Whatever be the nature of the Anthrax virus, there can be no doubt as to the potency of blood or serum containing it, when this is used for inoculation, even in almost infinitesimal quantities. The experiments hitherto recorded have been chiefly performed on rabbits and guinea-pigs—creatures extremely susceptible to blood-poisoning, and therefore the results are not so valuable or reliable. Delafond successfully inoculated one-fortieth of a drop of Anthrax blood, and Davaine killed a guinea-pig with the millionth part of a drop of this fluid, which had been mixed with water and defibrinated cow's blood. It has been found, however, that the virus derived from the rabbit is much more potent than that from the horse, and that a ten-thousandth dilution of septicæmic blood containing only a few vibriones, will rapidly cause death when inoculated. Blood in a state of putrefaction does not possess a toxical energy at all like this.

The contagium of Anthrax is essentially "fixed;" it only appears in exceptional cases to act in a "volatile" manner, and then it is in all probability carried by the cutaneous and pulmonary exhalations of diseased living animals, or along with the gases from their carcasses when dead.*

Its principal media are the blood, exudats, extravasats, and the spleen of the diseased animals; though there can be

* Garreau, the eminent French veterinary surgeon of Châteauneuf, who has made a most exhaustive study of this disease as it affects sheep, concludes that it is contagious, and capable of being transmitted by cohabitation and at a distance; that contagion by volatile virus, or at a distance, only takes place when the malady affects several animals of one flock at the same time, and with extreme violence; and that the infected atmosphere resulting from this mediate contagion does not appear to be capable of extending to any considerable distance.

no doubt that every part of the body—solid and fluid—is capable of transmitting the disease. It exists, however, in greatest intensity in the carbuncle, blood of the spleen, and the yellow or brown serosity effused during the course of the malady.

It varies in intensity in different animals, at different epochs of the outbreak, and also at different outbreaks, but usually in those cases in which death is most rapidly induced it is in its highest state of virulency; its exalted potency being most apparent during the life of the animal, or before its carcass becomes cold. It appears to be most energetic at the commencement of an outbreak, when the disease itself is most deadly. Gilbert, who, towards the end of the last century, published a very remarkable monograph on the malady, which he designated a "fièvre putride gangreneuse," asserts that, after sheep Small-pox, he did not know a more contagious disease of animals; that no species was exempt from its attacks, and that it passed readily from one to another.

Reynal's experiments in inoculation would appear to demonstrate that the contagium of Anthrax loses its potency by successive transmissions.

VITALITY OF THE VIRUS.

The potency of the virus, as has just been said, is greatest during the life of the animal, or immediately after its death. Nevertheless, the resistance of the contagium to external influences, such as that of the atmosphere, temperature, humidity, &c., is very considerable, and even remarkable. Putrefaction does not appear to affect it, for some time at least. Cases have been abundantly recorded in which the disease has been transmitted by suet, green and dried hides, and wool from affected animals; and it has been asserted that for months, and even for years, the soil beneath which animals that had perished from Anthrax was buried retained the property of communicating the disease, and even contaminated the plants growing thereon.

A high temperature does not appear to produce much effect upon it. Instances are numerous in which people have

experienced serious symptoms, and have even perished, after eating Anthrax flesh which had been cooked; and dogs and pigs have also succumbed after feeding upon it.

Delafond exposed blood from a diseased spleen to the air for fourteen days, and inoculated ten animals with it, but only two were affected. Vicq d'Azyr successfully inoculated with fluid from an animal that had been buried for several months, and Barthélemy with matter that had been kept for a year in a glass. Wolf, however, was unsuccessful with blood which had been preserved for two years.

A stable has been known to preserve its contagiousness for a year, even when disinfected and well aired, according to the report by Hildebrand. It has also been stated that litter buried with diseased cattle has, after three years, infected sheep.

Hartmann mentions an instance in which a cow-hide had hung for twelve months drying, and was then steeped for twenty-four hours in water, after which it was made into harness for two horses by a saddler. The latter became affected with malignant pustule. A shepherd who swam four weeks afterwards in the water in which this hide was steeping, infected twenty animals with Anthrax in one day. The horses wore the harness for four days, and on the fifth were attacked with splenic Apoplexy, which killed them in forty-eight hours.

Inoculation with the dried crust has produced the malady in animals, and malignant pustule has not unfrequently been produced in man, in this and other countries, by handling the dried hides of animals from South America.*

The vitality of the virus would appear to depend upon that of the bacteridia. Davaine's experiments show that, if due precautions are taken in drying Anthrax blood, these are preserved intact, and the disease may be communicated by it after more than a year; but if, before desiccation, the blood has become putrefied, they are destroyed, and that fluid has then lost its contagious properties, so far as Anthrax is concerned, though it may produce Septicæmia. Blood slowly

* Anthrax is frequent among people who handle horse-hair from Buenos Ayres, the saddlers who use badly-cleaned hair from Russia, and especially Siberia, and also among hair brush-makers in some parts of the Continent.

dried likewise sometimes loses its potency, because the bacteridia perish during the decomposition that occurs.*

It is not improbable that many of the cases recorded, in which infection occurred after a long interval, were those of Septicæmia, and not of Anthrax.

We shall again allude to this subject when treating of its infectious properties and mode of access.

INFECTION.

The receptivity for the contagium of Anthrax is an unfortunate privilege of probably every creature—even fish and crustaceans do not appear to be exempted. Of the larger mammals, it affects all those which are domesticated, and even undomesticated : never appearing without transmission in carnivorous animals and mankind, but arising spontaneously in herbivores and an omnivorous creature—the pig. Buffaloes, camels, deer (Spinola mentions an instance in which, in a certain area containing about 3000 deer, 800 died of Anthrax), reindeer (the epizoöty described by Wrangel as occurring among these animals in 1814, appears to have been most severe), and even the wild dischiggetais of the Steppes (Wlassof alludes to an outbreak among them in 1779) suffer at times, as well as bears, wolves, foxes, &c. Birds, and especially those which are graminivorous and carnivorous—fowls, geese, turkeys, ducks, pheasants, crows, magpies, ravens, hawks, &c.—are very susceptible. Fish of all kinds are equally liable to attack, even crustaceans suffering from the disease.

Neither age, sex, nor constitution afford any guarantee against its action ; and transmission is all the more certain when local conditions, as well as those of a more general kind—such as atmospherical perturbations, high temperature, &c.—

* Davaine has also shown by experiment that diluted Anthrax blood is rendered inert by exposure to a temperature of 131° Fahr. for five minutes, but ten minutes are required for 122°. When undiluted, it does not lose its virulency until submitted for a quarter of an hour to a heat of 124°. The bacteridia maintain their vitality in dried Anthrax blood when exposed to contact with common salt, and to a temperature of 212° for five minutes; this blood having killed animals inoculated with it. When moist, however, they are destroyed by a much lower temperature, as is shown above.

are favourable to the development and intensification of its infectious properties. This receptivity is consequently related to an Anthrax dyscrasy, more or less marked in man and animals.

The epizoötic constitution has undoubtedly some influence in increasing the power of the infection, or augmenting the receptive condition ; but it is generally observed that the species of animal has most influence, infection from the horse being always very certain and dangerous ; according to some authorities, that from the ox is frequently the same ; but from the sheep it is often very trifling, and sometimes merely local in its effects.

Experiments conducted by the medical association of Eure-et-Loire, tend to prove that the animal which most readily contracts Anthrax by inoculation is the sheep, next the rabbit, and then the horse and cow. The same experiments showed that the virus of the horse was least active. Renault and Reynal state that the dog and poultry are not readily inoculable, but that rabbits and sheep are most impressionable: solipeds being less so than ruminants.

The virus, in being transferred from one species to another, often loses its potency. According to Roche-Lubin, the pig resists inoculation with the blood of a different species, and Renault and Reynal have likewise noted, in several instances, that the virus of a cow which died from Anthrax had no effect when inoculated in horses and sheep ; and they assert that the virus of the latter animal is transferred most certainly not only to creatures of its own, but also to those of different species. It appears to be seldom, if ever, transmissible from one person to another, except by inoculation.

The form of the disease appearing after infection frequently enough differs very much from that which occasioned it. Thus, if due to accidental inoculation, it generally begins by local disturbance at the part where the virus was introduced, the general symptoms appearing subsequently;* but if it finds

* This statement must, however, be made with some degree of reserve. Quite recently, cases have been reported of people who died after manipulating the bodies or *débris* of diseased animals, without exhibiting any precursory local disturbance, or any trace of inoculation. As will be seen

access by the pulmonary or digestive organs, it usually produces a general form, with secondary localizations. Thus, in animals which have eaten the Anthrax flesh or blood, or swallowed contaminated matters, we have fever, quickly followed by swellings about the neck and throat, with other local phenomena.

There can be no doubt whatever as to the contagiousness of Anthrax by actual contact, or through the medium of contaminated substances. Thousands of observations, melancholy histories, and numerous experiments, testify to this fact. The malady has been produced in man and animals, through coming in contact, either directly or indirectly, with the bodies, excretions, or débris of diseased creatures —eating their flesh or blood, or the food, herbage, or water contaminated by them, by accidental or experimental inoculation, &c. Dogs which have been eating diseased flesh, and have soon afterwards bitten other animals, have pro-

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hereafter, a person died in Somersetshire, in August, 1873, apparently from inhaling the fumes from the flesh of an animal that had perished from the disease, and was being boiled for pigs. And Abadie, of Nantes (in the *Recueil* for November, 1873), states that a farmer had a very sick ox, which he sold to two butchers—father and son. These killed and dressed the animal, and in a few days the father was seized with a violent fever, accompanied by exacerbations in the evening, intense headache, and severe deep-seated pain in the region of the spleen. The symptoms increased until the fourth day, when the man became very cold, and on the fifth day perished. There was no trace of eruption on the surface of the body. The physician who attended him was not cognizant of this man having had anything to do with a diseased ox, and imagined the case to be one of Typhoid fever. The butcher's widow, however, informed him of the fact, and spoke of the immense size of the animal's spleen; also that the son had pricked his arm while skinning the animal, and next day the limb was so swollen that his life was almost despaired of. The physician was then enlightened as to the character of the malady; for only the previous year he had seen two young men, seventeen years of age, who had been employed by a farmer to skin an ox that had perished from an anthracoid disease, succumb in a few days afterwards, without showing any trace of puncture or other lesion of the skin.

Deaths from Anthrax infection may be far more common than is usually supposed, and might be erroneously set down to Typhus, Typhoid, or other fevers, owing to the medical attendants not knowing the history of the cases.

duced the disease in them by their teeth; veterinary surgeons and others have been infected through manipulating sick animals while alive, or their carcasses after they had succumbed, or by wounding their hands when doing so; and it is not at all unfrequent for people to receive the disease from applying the skins, hair, or wool of affected creatures to their bodies. This was a fact well known to the ancients; and Virgil, in his third Georgic, alludes to the transmission of the disease from sheep to mankind by means of the wool spun into clothing.

But if the presence of a "fixed" contagium has been indubitably ascertained and demonstrated, it is not so with regard to the "volatile" contagium. The infectiousness of the disease has been asserted and denied by the highest continental authorities, and the question cannot be said to be settled even now. The majority have shown themselves to be partisans of contagion at a distance, and they have adduced facts to prove that it is effected by diseased animals, infected localities, and by the remains of dead creatures.

Chabert states that the passage of a diseased animal through a place inhabited by healthy ones, will cause the production of the malady among them; and he could cite many instances to prove that an infected beast, introduced furtively into a commune, has caused the entire loss of the flocks therein. There are many eminent French veterinarians who hold this opinion, and adduce observations to prove its correctness. Many German authorities also entertain the same opinion, and cases have been published in this country which seem to be in favour of this mode of transmission.

With regard to infected localities, there are likewise many observations which really seem to corroborate the notion that the disease can be engendered among healthy animals if they frequent them. Roche-Lubin, an excellent authority, reports that healthy pigs placed in stys wherein were other pigs affected with Anthrax, contracted the disease. He adds that a he-goat and a sheep, placed about eight mètres (nine yards) from two diseased cows, died of the same malady—the goat on the tenth, and the sheep on the thirteenth day. Boutet

asserts that he has produced Anthrax in a healthy sheep, by causing it to cohabit with others which were affected. Noquet has seen the disease transmitted to an ass and a foal lodged in a stable communicating with another in which were cows suffering from the malady. Rougieux, in the outbreak among the fox-hounds already alluded to, desiring to ascertain the contagiousness of the malady, one night introduced a small street dog into one of the kennels most severely visited by Anthrax; it was taken out in the morning, and for several days did not manifest any abnormal symptoms. This, however, was not deemed a conclusive experiment, and another subsequently tried is quoted as conclusive. Five dogs kept in a house a short distance from the kennels, and which had not been fed on the Anthrax flesh, were allowed to run among the diseased animals on only one occasion, and several of them became affected.

Garreau, who made extensive researches into the pathology of Anthrax, has collected a large mass of testimony and personal observations in support of this view, which he warmly adopts. At Beauce, a part of France notorious for the prevalence of the disease, he has always observed it developed in consequence of the introduction of a sick animal, no matter of what species, among healthy stock. Of the numerous instances he gives, we may cite one, though he adduces other seven of a like nature to prove that newly-purchased animals, coming from uninfected localities, have died through living in places inhabited by sick ones. A farmer lost three cows from Anthrax in forty-eight hours; the stable in which they died was cleansed and disinfected, and two young cows, purchased in a locality where the disease did not prevail, were placed therein, the other cows occupying the lower end. In two days the malady re-appeared, and among the victims were the newly-purchased animals.

Mathieu has likewise seen animals die from Anthrax, after having been placed in buildings in which others had succumbed, but which had been washed, scraped, and lime-washed, and left empty for seventy days.

Roche-Lubin mentions the case of a farmer in Aveyron,

who, after losing six cows out of eight in the same stable, introduced four newly-purchased ones thirty-two days subsequently. These came from a district free from Anthrax, yet three of them died in twenty-two days. Another proprietor in the same locality, who had lost two cows from Anthrax, cleansed, washed, and disinfected the stable, and afterwards left it open during the night for a month. At the end of this period, the son of the farmer left a flock of thirty sheep for only a few hours in the stable; two days afterwards, fourteen had died. The same authority quotes the following experiments:—Nineteen cattle died in twenty-eight days, in a stable twenty-seven yards long and thirteen wide. This stable was closed as completely as possible, without being disinfected, for twenty days, when four sheep were put in it. Three of these died on the fifth day. The stable was again closed for thirty days; and at the expiration of this period, two sheep, a pig, and an ass were introduced. The last-named animal succumbed on the eleventh day, and the two sheep on the fourteenth.

Numerous other facts of a similar kind might be adduced, as tending to prove the possibility of infection by contaminated localities.

With regard to infection at a distance, many apparently reliable instances might also be furnished; but a few must suffice. Of the many reported by Garreau, the following, selected from a number of similar occurrences, are offered. A horse affected with inflammation of the jugular vein, stood for three hours in a stable where a sheep that died of Anthrax had been examined; it perished on the fifth day. Another horse succumbed to the same malady on the fifth day, after having been tied for an hour to the half-open door of a stable containing the carcass of a dead sheep that had been affected with Anthrax. A flock in which Anthrax prevailed, was transferred to a farm which had, up to that time, been exempt from the disease, and two of these animals were buried in a field. In ploughing the land, the plough brought their remains to the surface; nine days after, the two horses which drew the plough had perished from Anthrax. On the same

farm, a bull got loose, and smelled about the yet fresh soil beneath which one of the horses had been buried for twenty days. This bull died of Anthrax in forty hours, and infected the stable it inhabited.

Gilbert has seen a pig and eight young hogs die nearly all at once, through smelling the bloody traces of the carcass of a cow that he had caused to be dragged to the place where it was buried.

Roche-Lubin, Boutet, and Noquet give similar examples—all valuable, in so far as, like the above, they were observed in localities where the malady had not been seen previous to the arrival of affected animals.

We will only add one or two other instances of a more special kind. Roche-Lubin, in speaking of the death of the nineteen oxen above mentioned, says that, in concert with another person, eight days after the nineteen were interred he had two sheep tied up at forty paces from the graves containing these animals. The north wind blew in a few hours, and, as it chanced, it passed over these places before reaching the two sheep, which were submitted to its influence for eight hours. On the seventh day, the sheep were infected, and died. The graves were three feet in depth, and well covered with bushes and stones to keep off dogs and birds of prey.

Gillet (of Indre) states that, in 1855, by the advice of two veterinary surgeons, a person, named Dugomy, removed a flock of two hundred sheep, among which Anthrax had appeared, to a neighbouring domain, where there was an abundance of space. The steward of the gentleman to whom this domain belonged, permitted this emigration, on the statement of the owner of the flock, that the veterinary surgeons he had consulted assured him the malady was not contagious. The flock was accordingly placed in a sheep-fold adjoining one containing a flock belonging to the estate. Three of the new arrivals died during the first week, and eight of the home flock. The latter was purchased, as it stood, by Dugomy, who had the two flocks sent to his own farm again. Notwithstanding this removal of the infected animals, in two days after their departure a cow was found dead from Anthrax in

its stable, and during the same week three other cows, then an ox, and, finally, two mares, perished.

Gilbert mentions that, when Anthrax prevailed at Ablon, a number of oxen belonging to a person there died of the disease, and, in order to arrest its extension, the antiquated notion of interring one of them in the stable was resorted to. The ox which was placed immediately over the grave, as well as the two adjoining it, soon became affected. Gilbert, who had been sent officially to superintend the extinction of the outbreak, removed the thin layer of soil covering the carcass, replacing it by a quantity of quicklime, and then heaping a large mound of earth over all: putrefaction being so advanced, that exhumation of the body would have been most dangerous.

The same excellent authority mentions that a farmer near Charenton lost all the horses in a stable in which he had interred a carcass, with the same object.*

A good number of negative instances are, as might be expected, also published; and several high continental authorities are opposed to the opinion that Anthrax is infectious.

Barthélemy, a professor at Alfort many years ago, did not at all believe in its infectiousness, and he founded his disbelief on numerous experiments, in which he caused healthy animals to cohabit with others in which he had produced the disease by inoculation; the result of these cohabitations was always negative.

These experiments have been repeated with the same nonsuccess by Renault, of Alfort; and, besides, in a space of about twenty feet square, tenanted by sheep, he has hung the remains of animals which had died of Anthrax, so that they might be close to the heads of the occupants; these *débris* were renewed during fifteen days, but the sheep remained healthy. The same experiment was repeated a great number of times, during different years and seasons, and always with

* Columella informs us that one of the most ancient agricultural writers, Bolus Mendesius, of Egyptian origin, recommended that the first sheep attacked with erysipelatous Anthrax should be buried at the entrance to the sheep-fold, in order to drive away the disease! If the above facts are worth anything, this superstitious practice must have been a potent agency in its extension.

similar results; and in an epizoöty of Anthrax which he observed in Nièvre and Allier, no fact with regard to volatile contagion was reported.

Nevertheless, negative results with regard to infection or contagion are not, in themselves, of great weight, and in the presence of well-authenticated positive facts, they are valueless. The disease does not appear to have been much studied in this country with regard to its infectious properties; though I am acquainted with a few instances which appear to support the evidence of those who consider it to be capable of transmission to a certain distance.

It would appear that epizoötic or enzoötic Anthrax is more virulent than that which is sporadic; and there can scarcely be a doubt that the presence of diseased animals at only a short distance from healthy ones, and especially if in a confined atmosphere, may produce the transmission of the malady to the latter by infection. Such, at least, would seem to be proved by the careful observations of Continental veterinarians.

MODE OF INFECTION.

In ordinary conditions, transmission may take place by cohabitation of healthy with diseased animals; as in stables or sheds where they are closely packed and badly kept, and where they may receive the contagium through the medium of the atmosphere, or by actual contact; also through grazing on pastures which are, or have been recently, frequented by the diseased; by fodder contaminated by sick animals, surgical instruments, the teeth of dogs or other animals, stings of flies,* handling diseased creatures and afterwards healthy ones, &c. The contagious principle may attach itself to any

* It has been much debated whether the common fly, or the "blue-bottle," could produce the disease by inoculation of the matter it may have gathered on its feet or proboscis. It is very improbable that it can; though it must not be forgotten that the contagious Ophthalmia of Egypt and other countries is largely spread by flies. In "Animal Plagues," I have given a history of several epizoöties of carbuncular Anthrax in mankind and the lower animals, due to the stings or bites of swarms of insects; and others have been observed in America and on the continent of Europe during this century.

part of the body, but its action is most certain if the surface with which it comes in contact is wounded or abraded. At the part by which infection takes place, there appears to be, in the majority of cases, a local multiplication and elaboration of the virus in the form of a carbuncle (this is most frequent in the human species); from this the mass of blood becomes contaminated—sometimes in a few hours.

The disease may also be transmitted by experimental inoculation, as well as by the ingestion of the blood, flesh, &c., of diseased animals; the latter mode of infection occurs chiefly with mankind, dogs, pigs, poultry, and other creatures.

MODE OF ACCESS.

The most certain mode of access of the contagium is by inoculation, which seldom fails to produce the disease in a healthy animal. This inoculation may be accidental or experimental, but the results are the same. The virus is readily absorbed through a wound or abrasion, and the mucous membrane of the mouth, nostrils, or eyes, or even the thin skin of the arms, face, or other parts of the body, may admit it. The particular instances in which infection has followed the application of contagiferous media to these parts, are far too numerous to be fully noticed here.

Shrœckius, in describing a serious outbreak that occurred in Augsburg in 1712—in which horses, cattle, pigs, geese, fowls, and such wild animals as deer and boars, died in immense numbers—mentions that the horse of a nobleman was kept in a stable, near which some cattle that had perished were buried. One of these had been so badly interred, that soon after one of its limbs protruded above the ground. The groom, with an axe, proceeded to cut off this leg, and while doing so some matter flew into his eye; this quickly produced swelling and inflammation, which rapidly affected the other eye and the whole head, and the man soon died.

Veterinary surgeons, butchers, shepherds, knackers, and others, have, in innumerable instances, contracted the general form of the disease, anthracoid Erysipelas or malignant carbuncle, in opening, or only removing the skin from, animals

which have perished from Anthrax. It was sufficient that a drop of blood should get into their eye or nose, that an abrasion should exist on their hand or arm, or that they should rub their hands stained with blood on their face, or any other part of the body where the skin is thin, or that the veterinary surgeons should introduce their hand or arm into the mouth, vagina, or rectum, of a diseased animal, to develop the malady in them. Gilbert gives us an instance of a veterinary surgeon who perished in this way. He also mentions that, in 1793, when he was endeavouring to suppress an outbreak in Argenton, where many people had been affected with malignant pustule, and a number had perished (chiefly through foolishly believing in the virtues of holy water to dissipate these local symptoms), a drop of blood, which had passed through the seam of his glove and remained on his hand for less than a quarter of a hour, while he was examining a dead ox, produced a small ulcer, that could only be cured by immediate recourse to the hot iron severely applied. The horse he rode was also affected in the same way, notwithstanding every precaution in the way of preventing its coming into contact with diseased animals, and had to be treated in a similar manner. The same excellent authority also saw a horse attacked with an anthracoid tumour on the haunch, a few hours after carrying the fresh skin of a diseased ox in a sack. Almost every authority who has written on the disease gives similar instances, and numerous examples are recorded as having occurred in this country. Budd mentions one case of transmitted malignant pustule in a man, followed by death in twelve hours.

The Tartars, and people in Russia, Central Asia, and elsewhere, who have to do with horses and other animals, and who, during the hot season, when the disease mostly prevails, have their bodies much exposed, suffer greatly from infection through the skin.

Dr. Smith informs us of an epizoöty of Anthrax which occurred at Las Cruces, New Mexico, during the summer of 1865, at which time malignant pustule also prevailed as an epidemy in the human species. He gives the following instance of the production of the disease by contact with the

fluids of animals which had succumbed to the malady that raged among them. Two men were engaged in skinning an animal which had died. One of them had a pimple on his face, which he scratched with his nails until it bled ; the other had received a scratch on the face with his hands, covered as they were with the fluids of the animal. In a few hours, pustules were developed upon the abraded surfaces in both individuals, and the disease proved fatal in one of them.*

* In "Animal Plagues," very numerous instances are given of this transmission in nearly every epizoöty, and in nearly every climate. See more especially that in the Island of Grenada, in 1783, and in the French Antilles, in 1774.

Virgil accurately describes a terrible outbreak of Anthrax on the Timavus, which involved domesticated and wild animals in destruction ; and he also indicates the dangers of transmission to man :—

"The skins are useless, nor the tainted flesh
Can water cleanse, nor raging fire subdue ;
Nor is it possible to shear the fleece,
All saturated with disease and filthiness ;
Nor can the weaver touch the putrid web.
But should a man attempt the odious garb,
With burning pustules and disgusting sweat
His limbs offend ; and in no lengthen'd time,
The fire accurs'd consumes his poison'd frame."

Hartmann gives a curious anecdote with regard to the transmission of the disease. An unfortunate peasant, in a parish of Wibourg, found a bear which had died after gorging itself on the carcass of an ox that perished from Anthrax, and which it had disinterred. He skinned it, and carried home the hide; but he soon became unwell, and succumbed the following day. The magistrates of Wibourg, on being informed of this accident, issued an order that the skin was to be burned. But the priest who had buried the peasant, and had nothing but this skin to recompense him for his trouble, and who, like his brethren in general, did not like losing his dues, took possession of the article, and would not give it up. He had the skin dressed by a peasant, who died in twenty-four hours, as well as the two men who assisted him. Another order came from the magistrates to burn the pernicious hide, the house in which it had been dressed, and even the parsonage, if necessary. "How can it be possible—how can any one believe that this skin is capable of causing the death of a person ?" cried the priest, furious at the idea of losing his prey ; at the same time he rubbed it with his hands, smelled it, and soon after became sick and died.

Gamgee furnishes a striking illustration of the potency of the Anthrax

Hundreds of persons perish every year through infection in this way, and many animals are doubtless also contaminated in a similar manner, and especially by the bites of dogs which have been eating Anthrax flesh.

The virus may also obtain access by the air-passages and lungs; and it is not at all improbable that in those cases in which infection occurs at a distance, and without direct contact, that the contagium enters the system by this channel. Innumerable instances of this mode of contamination are to be found; but we may now only refer to the case of a man in Somersetshire, who, in October, 1873, had been occupied in boiling down a horse that had perished from Anthrax fever, was attacked with a *low fever* (which the medical attendant considered "a case of Typhus cut short in its course by rapid effusion on the brain, and induced by continual inhalation of the fumes of the putrid horse-flesh"), and died after three days' illness (*The Veterinarian*, December, 1873).

Of its admission by the digestive organs, there cannot remain the shadow of a doubt. The history of the disease teems with cases in which transmission has been effected in mankind and animals by consuming the raw—less frequently the cooked—flesh, blood, or *débris* of others which had succumbed to it; and death appears to have been almost, if not quite, as rapid as if it had obtained access at once to the blood.

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poison in affecting the unbroken skin. "I have seen various forms of Anthrax in the marshy plains of the Papal States during the summer months, especially in July, August, and September. The activity of the developed poison was very great, and one instance more particularly struck me. One of the fine white bullocks of the Roman States was conveyed in a cart to the slaughter-house at Ferrara, in the month of August, 1854. Professor Maffei condemned the animal as being affected with Carbuncular fever. The animal was buried. But a jobber determined to sell the flesh, and during the night disinterred the carcass. He removed the meat in bags to a hiding-place, and in doing so carried the bags over his shoulders. He had thrown off his jacket, and set to work in his shirt. Next morning a diffuse erysipelatous inflammation set up over the back, notwithstanding that no abrasion of the skin could be detected, and the juice of the flesh had to permeate through the bags and shirt. In three days the man was a corpse."

Matthew of Paris and other writers, allude to this circumstance in describing the great outbreak that occurred in the middle of the thirteenth century, when it was observed that "all the dogs and crows which fed on the bodies of the dead cattle immediately became affected, grew intensely swollen, and died on the spot. On this account, nobody dared to eat beef of any kind, for fear of being poisoned by this disease." Previous to this period, in England, Ireland, and other countries, outbreaks of Anthrax—some of them awfully destructive—were nearly always accompanied by a great mortality in the human species. And for nearly every subsequent year, up to the present time, there are records of its terrible ravages in some country or other, and its transmission to mankind and other creatures.*

Gilbert, alluding to the spread of the malady, says that nothing tends so much to its dissemination as not burying the carcasses sufficiently deep. Dogs, wolves, and bears disinter them, and nearly always infallibly perish; but most frequently not before they have communicated the disease to others, and have carried it to great distances. He has seen die of Anthrax, in one day, two bears and a wolf, to which the flesh of a horse that had perished of the malady was given. Dogs, hogs, birds, and wild creatures have perished in large numbers from ingesting such food; and death has been sometimes so

* *See* "Animal Plagues" for a record of these outbreaks from B.C. 1490 to A.D. 1800.

Anthrax was a terrible disease in many countries, so far as the human species was concerned, during the early and middle ages, and is still so in some regions at the present time (Russia for example). In England, so long ago as the thirteenth century (reign of Henry III.), a period marked by some startling epizoöties, the disease appears to have excited so much apprehension and dread, that laws were framed to protect the people, so far as the use of this flesh for food was concerned. Beef and pork were looked upon with great suspicion; and butchers were forbidden to sell contagious flesh, or that from animals which had died of the murrain (*carnes-suscientas vel morte morina*); to buy flesh of Jews (as if they were the dishonest carcass-dealers of that period), then sell it to Christians; or to sell measled pork or flesh dead of the murrain (*porcinas supsennuates, ut carnes de morina*).

rapid, that they have been found lying dead beside the carcass they were devouring. The flesh of every creature that has died of the disease is probably poisonous when eaten in a raw state. Simonds, in this country, mentions that pigs and dogs died in a few hours after devouring the flesh of sheep which had perished from "braxy." And Gamgee and other observers make similar statements.

We shall again refer to this important subject when speaking of the use of Anthrax flesh and milk as food. In the meantime, we may allude to three outbreaks of what were called "blood-poisoning," one of which occurred in Somersetshire, another in Wiltshire, and the third in Devonshire: all being described in the *Veterinarian* for December, 1873.

That in Somersetshire is the most interesting, and also the most lamentable, as a man (referred to above) lost his life through infection. The outbreak began among sheep, several of which died, and were examined and cut up for the use of dogs, in a field occupied at night by horses, and in which was a pond where they drank. Soon afterwards, a horse, pastured in this field, died in about twenty-four hours, and was skinned and opened at a spot inclining to, and about ten yards from, the pond. About ten days afterwards, another horse died in about three hours, and was dealt with in a similar manner; and others continued to succumb, at intervals of a few days, until seven had been lost out of eleven, three of the four remaining not having been on the contaminated pasture, nor had they drank the pond water. In this case the contagion may have been communicated from the soiled herbage eaten by the horses, by drinking the water polluted by the soakage from the remains of the dead animals, or even by inhaling the pestiferous emanations from the ground. What is most relevant to our present inquiry, is the fact that two ferrets, two pigs, a cat, and a dog, which partook of the raw flesh, died suddenly, and without exhibiting any premonitory symptoms of ill-health. "Indeed, so rapidly fatal did the disease prove, that the cat was found dead by the carcass, and is presumed to have died in the act of eating the flesh." A portion of the carcass of one of the horses was taken to a neighbouring vil-

lage, and boiled down for pigs. Two of these animals died, and, as has been mentioned, the man who boiled the flesh. It must be noted, however, that on examination by the medical attendant, the latter was found to have a slight wound on the knuckle of the right thumb, with some tumefaction of the surrounding parts, but no inflammation of the lymphatics; so that he might have been inoculated with the Anthrax virus.

In Wiltshire, a cow died from apoplectic Anthrax, and the flesh was given to pigs, dogs, and cats. And it was reported: "All the animals which ate the flesh are either now dead or dying, and they have all shown one particular symptom—great swelling about the neck. Seven fine sows are already dead, and each one had her neck swollen to a great size. I have seen one of the cats, and the same symptom is present."

In Exeter, sudden deaths among cattle occurred from Anthrax in the apoplectic form, and also from anthracoid Angina, and the flesh of these animals caused the death of pigs.

As has been before stated, we shall refer to this mode of access hereafter.

INCUBATION.

The period that elapses between the reception of the contagium and the manifestation of the earliest symptoms is variable, and appears to depend not only upon the activity of the virus, but also upon individual predisposition, idiocrasy, and other circumstances which modify the action of these animal poisons. It may be only an hour; much more frequently it is twelve to twenty-four hours, though it is rare that it extends beyond the third or fourth day after contamination. The longest period recorded, I believe, is twelve days.

After direct or experimental inoculation, the disease does not usually appear sooner than in twelve, twenty-four, or thirty-six hours. The carefully-conducted experiments of Garreau and Renault show this to be the case, and also that the animals they experimented upon did not die for four or five days after inoculation.

EXTENSION.

When the malady appears in a sporadic form, which it usually does now-a-days in this country, its powers of extension appear to be limited, and it is ordinarily spread by the diffusion of its virus on certain portions of the pasture on which diseased animals have been grazing, in foul and confined stables, by means of water and food, by actual contact of the healthy with the diseased when circumstances are favourable, or by exhalations from the bodies of the living or their carcasses when dead. Accidental inoculation must also be looked upon as a mode of extension; a shepherd's dog, for instance, which has been eating diseased flesh, may inoculate a number of the sheep by biting them, and this may spread the disease.

The exhalations from dead creatures have no doubt a powerful influence in this extension. The terrible outbreaks of Anthrax which occur so frequently in the annals of epizoöties were, in all probability, largely due to carnivorous animals, such as dogs, foxes, wolves, bears, and rapacious birds, eating the carcasses of some few herbivores which had perished from the malady, and then retiring to the woods to die, have disseminated the contagion far and wide, their exhalations and their flesh infecting others.

When the malady appears in an enzoötic or epizoötic form in a country, as a rule only a few animals are at first attacked, and that suddenly, death taking place very quickly. These are usually the best-conditioned and most healthy-looking animals. An interval of a few days then occurs, and a larger number of cases are announced, and so on; the intervals also become shorter, and the cases more numerous, until the malady becomes widespread, and no longer attacks only those which are in the finest condition or the most robust health, but seizes upon the feeble and emaciated as well.

If the conditions are favourable for its development and maintenance, it may acquire most formidable dimensions, and continue for a long time, its extension being greatly accelerated by its contagious properties.

These devastating outbreaks have generally commenced in regions where the malady may be said to be enzoötic; and it is noteworthy that all the great epizoöties which history informs us have ravaged the continent of Europe, have originated in sub-alpine France—in Dauphiné or Auvergne—and have spread thence as from a centre, sometimes but a short distance, at other times a long way in every direction, and generally by Germany into Poland: though there does not appear any evidence that they ever reached England, possibly for reasons which need not be alluded to here. Some of these outbreaks continued for a year, others for two; and it has frequently been observed that a sudden frost, a severe thunderstorm, or some other similar phenomenon, has checked their progress, or altogether suppressed them.

MORTALITY AND LOSS.

Anthrax in its different forms is a very deadly disease, and one that causes immense destruction in the countries in which it most frequently and widely prevails. True, in certain outbreaks it assumes a less malignant character than in others; but it is always most fatal in those localities in which it has not appeared for some time, as well as at the commencement of an outbreak. In regions where it is enzoötic, or at a late period in the course of an epizoöty, recoveries are more numerous.

In the very acute form, and especially when there is no localization, the mortality is always great, and recovery extremely rare. It is less fatal if localized, so long as the localization does not occur in important organs, or interfere with essential functions. When swellings appear in the neighbourhood of the larynx—as in anthracoid Angina, for instance—death is nearly always the result. A sudden disappearance of the tumours is generally a serious symptom.

When the malady occurs in summer, or unseasonably warm weather, the loss, as a rule, is great. In a flock of sheep, for instance, if it comprises one, two, or three hundred, one, two, three, or four animals will be attacked in one day, and quickly die. In certain circumstances, the loss may be higher, rising

to a twentieth, fifteenth, or one-tenth of the flock. The next day, and the following days, the disease will continue with more or less violence, and will probably not cease until it has swept away a third, fourth, or fifth part of the whole, and sometimes will not terminate until the flock has been moved to another locality.

The mortality is perhaps greatest in the sheep, in which nearly all those attacked perish; it is less so in the horse and pig, and still less in cattle. But there is no definite information to guide us in making this statement. The mortality is heavy in every species. One half at least of the horses affected with the so-called "typhus," perish when it assumes an epizoötic form. Those which are not in good condition, or are suffering from any other affection, succumb in largest numbers; Pneumonia, for instance, rapidly runs on to gangrene, and is readily developed in the equine species. The disease is also most fatal in horses which exhibit violent symptoms of Colic, indicating the occurrence of considerable infiltrations into the intestinal mucous membrane; in those which have the lower part of the head much swollen; in those which have infiltrations into the pharyngeal region, causing death by Asphyxia or pulmonary Œdema; or in those in which the external swellings disappear suddenly.

A glance at the history of the disease will show that it is one of those which inflict a great loss on agriculture, and indirectly on the well-being of communities. In addition to this, there is the terrible fact that it is transmissible to man, and produces a disease almost equally fatal and rapid.

Some countries suffer much more from its ravages than others, and different species of animals are more susceptible to its attacks in one country than another. In Great Britain, where the disease has received but little attention, though it has prevailed, and does prevail, extensively at times, we can form no estimate of the heavy losses it inflicts. Sometimes in Scotland, according to Professor Dick, nineteen out of every twenty attacked perish. In the Highlands (Colonsay), according to the same authority, "Black-leg" carried off twenty to twenty-five per cent. of the cattle. Fifty per cent. of all the

young sheep that die in Scotland, are supposed to perish from "braxy." Roche-Lubin mentions that of 4,840 animals attacked with epizoötic or enzoötic Anthrax, 3,630 died.

In 1757, at the end of summer and commencement of the autumn, the disease broke out among horses, cattle, deer, asses, hogs, dogs, fowls, and even fish, in the province of Brie, France. The malady appears to have arisen in the marshy forest of Crecy, and to have raged in its vicinity to such an extent that, from June 15 to July 31, 490 animals were attacked, of which 290 (among them 162 horses, 80 oxen, and 38 asses) died. Many flocks of sheep were entirely swept away in the various cantons of Brie, and people suffered very much from the infection.

In Hanover, anthracoid Erysipelas became epizoötic among the pigs in 1786, and in some districts it killed a third, half, and even two-thirds of the porcine population.

This will give somewhat of an idea of its ravages, though much more serious outbreaks than these are on record.

Of all the diseases affecting sheep in some countries, this is the most serious. In some regions where it usually prevails, as in Beauce, France, the annual loss it causes varies from one-twentieth to one-tenth of the entire flocks, rarely descending below the latter proportion. According to the French official statistics, the arrondissement of Chartres has lost on an average, from 1862 to 1872, 22,250 sheep every year, of which it has been estimated 17,800 have died of splenic Apoplexy (Sang-de-rate). In Beauce it has been calculated that the losses from this disease amount yearly to 178,000 sheep, which, valuing them as Reynal has done, at thirty francs each—a very low estimate—amounts to no less than 4,340,000 francs, or £1,047,500 for Beauce alone. Delafond, in 1842, when sheep were much less valuable than they now are, and were also more numerous, estimated the loss at 7,080,000 francs. The disease also prevails among sheep in Brie, Champagne, Berry, Poitou, Auvergne, Dauphiné, Bourgogne, and other parts; so that we can form some sort of notion as to the scourge Anthrax is among the ovine population of France only. Indeed, Reynal asserts that it is infinitely more

deadly among sheep than any other species, as daily observation, as well as statistics, shows that on an average a hundred sheep die for every horse, or every two cows. So that it appears, notwithstanding the higher value of the latter, that the pecuniary loss in sheep is greater than in the other two species.

In Russia, the malady appears to be most fatal to horses and cattle, and less so to sheep and goats, these not being exposed to the same influences. When it prevails as an epizoöty, all animals attacked perish—even carnivorous creatures, birds, fish, and man himself being involved in the contagion. Every year it appears in the Governments of Novgorod, Olonetz, St. Petersburg, Esthonia, Livonia, Witebsk, Tver, Jaroslaw, &c., and in Finland. It appears to be sporadic in these, but in some years it becomes readily epizoötic, particularly in the two first-named Governments; and there are years in which it makes more victims in European Russia than in Siberia. In the Government of Witebsk, in 1839, 721 animals were attacked; in 1840, 424; in 1841, 1,988; in 1850, 1,392; in 1855, 3,275; in 1856, 656; in 1858, 2,213; in 1860, 907; in 1861, 1,174; in 1864, 569. In 1837, in one district alone, 1,900 horses died; in 1857, throughout the Russian empire, it was reported that 100,000 horses had perished from the disease; and in 1860, 13,104 cattle, out of 18,883 attacked with the "Jaswa," succumbed.

From January 15th to March 27th, 1865, no fewer than 47,000 cattle, 2,543 horses, and 57,844 other domesticated animals were lost in the Departments or Governments of Minsk, Vitepsk, and Mohilew. From the official report for the year 1864, it appears that in the five Governments of St. Petersburg, Novgorod, Olonetz, Tver, and Jaroslaw 10,000 animals died, most of them horses, few cattle, and fewer sheep. More than 1,000 persons perished of the disease. In the Government of Tobolsk, in June and July, 1874, there perished from the "Siberian plague," 4735 horses, 516 cattle, 1030 sheep, 52 pigs, and 15 goats; 106 human beings also died through infection.

IMMUNITY.

One attack of the disease does not afford immunity from

another. Gilbert has witnessed two, and even three, attacks in the same animal.

SANITARY MEASURES.

The sanitary measures are those relating to prevention and suppression. The first is by far the most important.

PREVENTION.

The prevention of Anthrax in its different forms presupposes a knowledge of the circumstances under which it is generated and developed; and we have seen, when studying its etiology, that our knowledge is still far from being perfect with regard to the nature of the causes which produce it. But so far as this goes, and so far as we are acquainted with the predisposing causes, the prevention of Anthrax should be attempted, and in many cases the attempt will be attended with success.

The first thing to be done, of course, is to remove the ascertained exciting and predisposing or occasional causes, and to pay particular attention to the feeding and hygienic treatment of the animals most exposed and disposed to the disease.

The nature of the diet and the character of the locality, have much influence in producing, as well as in averting, Anthrax.

In districts where the disease appears, or is likely to appear, the authorities should give instructions to those most concerned, as to the nature of the malady and the best known means of averting it in their animals and themselves.

Should it prevail in neighbouring localities, communication with them, so far as cattle and other animals are concerned, and the movement of animals therefrom, as well as the issue of flesh or the *débris* of animals, ought to be suspended as rigorously as possible.

The therapeutic preventive measures are simple. If the animals are in high condition, saline purgatives ought to be given, should there be any tendency to constipation. The water given to drink should be slightly acidulated, with sulphuric acid, or chlorine water may be administered every day. Bleeding has been highly lauded on the Continent, and for

very many years setons and rowels have been largely employed, and evidently with advantage. With sheep, bleeding demands careful consideration.

The food and water should be of good quality, and a frequent change of diet may be advisable. It may be necessary in some cases to diminish the allowance of food, and to give it more frequently. Sprinkling it with dilute sulphuric acid is judicious.

Fatigue and exposure to a high temperature should be avoided.

SUPPRESSIVE MEASURES.

The suppressive measures necessary in an outbreak of Anthrax, no matter what form it may assume, are those applicable to epizoötic or enzoötic contagious diseases in general. The chief of these are, of course, isolation, and a declaration as to the existence of the malady: especially when it appears among other animals than sheep, with which isolation cannot sometimes be easily practised.

The healthy animals should be separated from the diseased, lodged elsewhere, and attended to by men who have no communication with the latter. At the same time, the existence of the malady should be declared to the proper authorities.

The men who attend to the diseased animals should be instructed to adopt the most minute precautions while so employed, with regard to themselves, and not to allow blood, saliva, or any matter from the tumours, swellings, or other parts of the affected creatures, to remain on their skin, as this contact may have the most serious consequences. Men who have wounds, abrasions, or any kind of eruption on their hands or face, should not be allotted to this duty; and even if their skin is perfectly intact, they ought to be careful not to introduce their uncovered hands into the mouth or rectum of the diseased, to directly inhale their breath, or to be soiled with the saliva; and the greatest circumspection should be observed by those who skin, dissect, cut up, or boil the carcasses of these animals. The hands should be covered with gloves, or otherwise protected; and if the skin should chance to be soiled, it must be carefully washed with soap and water, and after-

wards sponged with a weak solution of carbolic or some other acid.

Veterinary surgeons should likewise scrupulously observe these precautions. Before proceeding to explore the mouth or rectum, or to perform any operation, such as scarifying the tumours, inserting setons, bleeding, or dissecting the carcass of any animal which has died, they should either put on gloves, or smear their hands thoroughly with oil, tallow, or glycerine.*

The blood, setons or dressings, or other matters from the diseased, should be destroyed at once, or deeply buried, so that neither pigs, dogs, birds, &c., may be contaminated by eating or coming in contact with them.

Pigs, dogs, cats, fowls, and other creatures, should not be allowed to approach the pastures or stables inhabited by diseased animals, or the sewers, drains or ponds in communication with these.

The *débris* of animals which have died from Anthrax, should be removed with every precaution, to the place of interment. The carcasses of sheep and pigs should not be skinned, but have the hides slashed extensively in different directions, so that these cannot be utilized. The carcasses of horses and cattle which have succumbed to the very acute forms, ought to be treated in the same manner, in order to avert the danger to which the men who usually remove the skins are exposed. In the less acute varieties of the malady in equine and bovine animals, the skins may be permitted to be removed; though this should not be attempted until the body is quite cold, and due precautions must be adopted. The skins, together with the hoofs and horns, if these are removed, should be disinfected. The tallow should not be utilized.†

* Many lamentable accidents, followed by fatal results, have occurred to veterinary surgeons through neglecting these precautions. Inoculation from trifling wounds, or infection from the blood, exudations, or other matters being allowed to remain too long on the skin, or even from inhaling the breath or strong exhalations of a diseased animal, have been the cause of death in hundreds of instances.

† Where it is possible to utilize the hides and carcasses of animals, without danger to the knackers and others, it appears that in France such is

The dissection of dead animals ought not to be commenced before the carcass is quite cold, and every care should be adopted to prevent inoculation.

The flesh of animals which have died from, or been slaughtered in consequence of, Anthrax, or even suspected of being affected with that disease, must not be used as food, and the butchers and low dealers in the locality should be closely watched. The use of the milk should also be interdicted.

The stables or buildings in which the animals contracted the disease, or in which they died, should be well cleansed and aired, and afterwards thoroughly disinfected and again ventilated for several weeks. If there is no paving, the soil should be removed to a certain depth, and replaced by new earth. All the woodwork of any value must be well limewashed; everything of no great value ought to be burned; iron objects should be passed through the fire. No new animals should be admitted to these places for several weeks, and those which have been in contact with the diseased should be considered as suspected for a certain period.

The most scrupulous care should be observed in interring the carcasses and remains of animals sufficiently deep, and in removing all traces of them. The graves ought, if possible, to be dug in a place not likely to be frequented by animals. The litter and manure should be carefully burned, or buried.

With regard to sheep, these measures should be adopted, as far as practicable, and the same precautions ought to be observed. The advantages offered by emigration in getting rid of the disease, when it appears in a flock, are great; indeed, in nearly every instance in which it has been tried, the effect was marvellous, and in some cases almost instantaneous. In twenty-four or forty-eight hours afrer arrival in the new locality, the malady ceases; indeed, so certain is this

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allowed. The knackers take every care of themselves in manipulating the *débris* of such animals,—the skins are removed with due precaution, and dried in a place set apart for the purpose, and the carcass is boiled down in huge boilers for the sake of the tallow. According to Reynal, no sensible inconvenience has resulted from this arrangement.

measure, that, according to Reynal, it is attended with beneficial results in ninety-nine out of every hundred cases in which it is tried.

It is, therefore, a most beneficial measure, and one which ought to be resorted to whenever the disease develops itself in a flock, should circumstances permit. If possible, the emigration ought to be made to a pasture four, six, or more miles distant, according to the topographical and other features of the country, and the soil should be different from that on which the disease has occurred ; it will be all the better, sometimes, if the locality is tolerably wooded.

Of course, every precaution should be adopted during the emigration, to prevent communication with other flocks or the contamination of pastures. Sheep dying by the way should be buried deeply in unfrequented places. The owner of the flock should be held responsible for any damage that may result from carelessness in adopting or carrying out the necessary precautions.

With regard to Anthrax in the pig, the malady is very contagious, and the odour from the diseased is very strong. The strictest isolation should therefore be practised ; and cleanliness, thorough ventilation, and good food prescribed. Disinfectants should be liberally employed.

CURATIVE MEASURES.

The curative measures adopted, though requiring modification according to the different forms of the disease and the species of animal attacked, are generally the following. With well fed, high-conditioned animals, when the disease threatens to be very rapid in its course, a large and, if necessary, repeated, abstraction of blood is effected ; but with weakly animals and sheep this is often injurious, and need not be practised. At the commencement of the malady saline purgatives, such as the sulphate of magnesia, potass or soda, with nitre, camphor, or spirits of turpentine should be given, and repeated enemas of salt water administered. Soon after diluted acids, mineral or vegetable, may be prescribed, and mixed with the water given to drink ; or if the animals are averse to this, and will not take it voluntarily, it may be administered.

Chlorine water has been recommended; and carbolic acid, at frequent intervals, in draught as well as in enema, has been favourably reported upon. Pure fresh water should be liberally allowed.

With the dog and pig—animals which can vomit—the treatment usually begins with emetics, and the saline purgatives and acids follow.

It is advantageous to sponge over the body with cold water repeatedly, and for a considerable time, the surface being well rubbed afterwards. This treatment should not be adopted with the sheep. The pig is often benefited by several baths of this kind during the day.

With the horse, camphorated spirits of wine or spirits of turpentine have been applied several times a day to the surface of the body, each application being followed by energetic and prolonged rubbing.

If the animals are debilitated, and symptoms of low fever are manifested, with prostration and stupor, stimulants—such as æther, alcohol, spirits of turpentine—with antiputrescents—such as carbolic acid—must be resorted to. Setons and rowels, as well as stimulating frictions to the exterior of the body of horses and cattle, are likewise recommended in these cases.

When the disease is localized externally, the following is usually the treatment pursued. The erysipelatous tumefactions should be frequently douched with cold or acidulated water, and well rubbed; on the Continent, a paste of clay and vinegar is sometimes applied. Incisions or vesicant applications are generally contra-indicated in the treatment of these swellings, as extensive gangrene is often the result. Should the swellings open spontaneously, and a gangrenous sanies or exudat flow from the fissures, they should be dressed with turpentine liniment, a solution of chloride of lime or carbolic acid, &c.

The Anthrax tumours or carbuncles should be incised in a crucial manner throughout their entire depth, as well as breadth, until the healthy tissues are reached; this can readily be done, as they are completely insensible. Their contents should then be expelled as thoroughly as possible, and the wound ought to be immediately freely cauterized with the hot iron, terchloride

of antimony, or the strong mineral acids, repeating their application until the bleeding ceases. Or the spirits of turpentine, tincture of cantharides, or a strong solution of carbolic acid, may be employed.* At a later period, when the tissues are much disorganized, the elimination of the slough resulting from the operation is greatly retarded by a local atony; this must be overcome by poultices and stimulating applications. Indeed, Spinola recommends the application of poultices to

* In October, 1873, Doctor Déclat presented a communication to the *Académie des Sciences* on the treatment of Anthrax, in which he states that this disease in man, as well as in the larger animals, is nearly always successfully combated by his method when resorted to at its commencement, and very often when it is in an advanced stage. His treatment is to cauterize the initial pustule or swelling, frequently and vigorously, with pure carbolic acid, or, still better, with the carbolate of ammonia, thus destroying the source of the poison. Carbolic acid is also given internally in doses of 1 to 2 grammes in syrup ($\frac{1}{2}$ to 100) in twenty-four hours for an adult man. If the malady is of several days duration, and symptoms of intoxication are present, with vomiting, four subcutaneous injections of 100 drops each ($2\frac{1}{2}$ to 100) must be administered in addition, to be repeated in an hour if the symptoms are not ameliorated. If improvement does not take place in two hours, a draught composed of 1 gramme of carbolate of ammonia in syrup ($\frac{1}{2}$ to 100) must be given once a day, and four injections (subcutaneous) with the same substance ($2\frac{1}{2}$ to 100).

With regard to large animals, the treatment is the same, except that the dose in draught should be 10 to 20 grammes in aqueous solution ($\frac{1}{2}$ or $\frac{3}{4}$ to 100) in twenty-four hours; with injections (subcutaneous—$2\frac{1}{2}$ to 100) either of carbolic acid or carbolate of ammonia. Each injection may be 100 grammes; but it should never exceed 10 grammes of carbolic acid, or 5 grammes carbolate of ammonia, in the twenty-four hours. In an extreme case it should be trebled, if necessary.

With the horse, subcutaneous injections of the carbolate of ammonia cause the formation of abscesses. The Anthrax fever of the sheep *(Sange-de-rate)* is only successfully combated with carbolate of ammonia, in proportionate injections and in draught.

The carbolate of ammonia should be prepared by means of gaseous ammonia and crystallized carbolic acid; and it ought to be recently prepared, as it soon alters. It is well to filter the solution when it is about to be used.

Davaine has proposed the application of an iron heated to 124° to the surface of the tumours; he has also recommended the subcutaneous injection of iodine (1 to 6000 or 4000). For the disease, in a general form, Cezard recommends the intra-venous injection of iodine; he has injected as much as 8 grammes of iodide of potassium into the jugular of a horse with impunity.

the tumours at the commencement of their formation, after they have been incised as deep as the healthy tissues, in order to induce speedy suppuration.

The same kind of treatment is to be adopted with the Anthrax tumours which have become emphysematous.

The diseased animals should be placed in a roomy, well-aired place, plentifully littered and cool. Fresh cold water, slightly acidulated with some mineral acid, should be given to drink, or bran or oatmeal gruel. The only food should be a little hay or green forage damped with salt and water.

With regard to the special forms: in the horse, in the non-localized variety, large abstractions of blood have been sanctioned, with cold ablutions, or sprinkling the body with camphorated spirits of wine or spirits of turpentine, followed by energetic wispings, cold compresses on the head, with the administration of sulphate of soda or carbolic acid in large doses internally. When symptoms of violent Colic appear and the animals persist in lying down, they should, in addition, be compelled to move about at a walking pace for a considerable time.

In the so-called "typhus" of this animal, when only signs of a catarrhal inflammation are present, recourse may be had to small and often repeated doses of saline medicines, with tonics and stimulants, and especially if the animals are aged or debilitated. When symptoms of Colic appear, Röll recommends infusion of camomile in combination with liver of antimony; and when stupor becomes considerable, stimulants combined with camphor, or spirits of turpentine, several times a day. If the Diarrhœa is profuse, alum, or acetate of lead administered in mucilage, with opium, must be given; also enemas of a similar composition. When the Diarrhœa becomes sanguinolent, enemas of cold water may be employed. Should there be obstinate constipation, the rectum must be emptied, and enemas of soap and water administered.

When there appears to be a considerable determination of blood towards the head, and the stupor is very great, cold water compresses should be applied to this region. Frequent rubbings with wisps over the whole body, but especially on the swellings, are necessary, and are rendered more beneficial

by sprinkling the skin at the same time with camphorated spirits of wine or turpentine. When difficulty in swallowing exists, the application of compresses saturated with tepid water around the parotideal region may become necessary; and when asphyxia is imminent, because of the swelling of the head and neck, tracheotomy may be beneficial if resorted to in time. The tube may remain in the orifice for from eight to fifteen days, or even longer, if the wound is kept clean and the instrument is properly made.

Fissures in the skin should be treated with Goulard's extract; or, if they are deep and situated on the limbs, with pledgets of tow smeared with acetate of lead ointment. Scarifications or setons should not be resorted to.

With regard to the ox, the treatment already indicated is applicable in the apoplectic and febrile varieties.

Glossanthrax is cured by timeously incising (by means of scissors) and destroying the vesicles in the mouth. So that when the disease is prevalent, it is a wise precaution to inspect this aperture frequently in healthy animals; and as soon as a vesicle is perceived the tongue should be carefully seized, the part incised and thoroughly cauterized with sulphuric, hydrochloric, or nitric acid, or a solution of sulphate of copper; the actual cautery may also be used with the same object, and the mouth afterwards washed with a strong solution of salt. Should there be gangrenous ulcers beneath the eschar, the latter ought to be removed and the sore treated like the vesicle. It may be necessary to scarify the tongue, should it be much swollen. In all cases, care must be taken that the discharge does not escape towards the back part of the throat, or be swallowed by the animal; and those who perform this operation, and dress the mouth, should be careful not to soil their hands, face, or any other part of their body, with this matter, nor inhale the breath of the diseased animal.

The internal treatment is the same as for the other forms.

Anthracoid tumours in the rectum should be treated by cold, slightly acidulated enemas, and cold water douches to the spine. The rectum should not be evacuated by the hand, as there is great danger of infection. The other parts of the

treatment are similar to those for Anthrax in general; and the same may be said of the other forms of Anthrax in the ox.

With the sheep, in addition to the treatment recommended for Anthrax in general, chlorine water and chloride of lime have been prescribed.

In the erysipelatous forms, acids and salines are most useful. Bleeding is injurious.

The Anthrax fever of the pig, whether accompanied or not with eruption, is best treated with tonic and stimulant medicines frequently repeated. Carbolic acid, sulphuric acid, and camphor have all been recommended; as have also laxative enemas. Externally, sinapisms are applied, with frictions of spirits of turpentine, warm vinegar, or ammoniacal liniment. The cold douche is also highly spoken of, the pigs being put in a cold water bath twice a day, or oftener, for four minutes at a time. Or cold water may be dashed over them.

When tumours appear externally, the same medicines must be employed; the tumours should be incised with the bistoury or cautery, and dressed with some stimulating application, as spirits of turpentine—gangrenous parts should be excised and the wounds treated with carbolic acid solution. It has even been recommended to incise the black patches which appear on the skin, and dress them with spirits of turpentine. Tonics and careful feeding are recommended when convalescence is sitting in.

Glossanthrax should be treated as has been directed for the ox.

In anthracoid Angina, when there is time for treatment, bleeding and an emetic are prescribed, with acidulated and tonic and stimulant drinks, and powerful counter-irritants to the neck. The actual cautery has also been most beneficially applied to this region, the part being afterwards dressed with dilute hydrochloric acid. In administering medicines by the mouth, care must be taken that the animal is not choked. If they cannot be so given, stimulating enemas must be resorted to.

With Poultry, the diet should be of a tonic nature, and forge water should be given them to drink.

USE OF ANTHRAX FLESH AS FOOD.

We have stated, when speaking of the suppressive measures necessary for the extinction of this disease, that the flesh of diseased animals should not be utilized as food. The reasons for this prohibition are to be found in the facility with which Anthrax can be communicated by actual contact with matter impregnated with its virus, the wonderful vitality of this virus, the extensive alterations that take place in the various tissues involved, and the rapidity with which putrefaction sets in after death.

We have already given some instances of the evil effects following the consumption of this flesh. The "History of Animal Plagues" teems with melancholy examples of accidents of this description, and we can now only refer to a few more of these: not going beyond the last century, except to mention that the Jesuit Kircher mentions that, in 1617, the disease prevailed in the neighbourhood of Naples, destroying a great number of cattle, and that more than 60,000 people who had eaten of their flesh perished.

Barberet, speaking of the epizoöty of Anthrax that caused so much havoc in the Island of Minorca in 1756, states that the cowherds and others who ate the flesh of the diseased animals died from a malignant fever, accompanied, on the second day, by gangrene of the limbs. Bertin, describing the epizoöty in Guadeloupe, in 1774, assures us that the negroes who consumed the cooked flesh died after two or three fits of fever, which resembled those of ordinary humoral fever. Worloch, for an outbreak in St. Domingo, and Chisholm, speaking of another in the Island of Grenada, in 1783, cite similar casualties. Livingstone mentions that, in South Africa, people frequently die from eating this flesh. Enaux and Chaussier give an instance of a man who succumbed to a derangement of the stomach, after eating the flesh of an animal that had perished from Anthrax. Fauvel and Verheyen also give many instances occurring at Rome and in Germany. The first saw three persons, in one family of seven, die through having consumed Anthrax flesh. Menschel reports an instance in which

twenty-four persons were attacked with malignant pustule, many of them from eating the flesh of beasts suffering from Anthrax, the minority from direct inoculation. Those who consumed the flesh were affected in from three to ten days; the inoculated in from three to six days. In the first category, the carbuncle appeared in two cases on the upper arm, in three on the fore-arm, in nine on the face and head. The gangrenous process quickly extended, and five of the twenty-four died. One woman ate flesh and broth, another ate the same flesh, but threw away the broth; the first was severely attacked, but the second had only Diarrhœa. It was also stated that pigs which were fed on the flesh became infected, and that a woman who ate some of this diseased pork was subsequently ill. Pigs and other animals also perished.

It is presumed that in these cases the flesh was more or less cooked, for we have already alluded to the great facility with which the uncooked flesh may communicate the disease. Cases of death or serious illness following the ingestion of such food by the lower animals, have been recorded from the earliest times up to the present day.

But the evidence with regard to cooked flesh is far from being unanimous. Duhamel, for instance, mentions that an ox communicated malignant pustule to four persons—three who killed and dressed it, and the surgeon who opened one of the pustules; but that its flesh was afterwards well dressed by a butcher, and eaten—roasted or boiled—by more than a hundred people, who found it good, and suffered no inconvenience. Thomassin, in a dissertation on the malignant pustule in Burgundy, states that the flesh of an ox which had communicated malignant carbuncle to the butcher who had killed and dressed it, was entirely consumed in a village without any evil results. Morand, in 1767, gives a similar instance. Two butchers contracted malignant pustule, through cutting up an ox that had been affected with Anthrax; yet the flesh was eaten at the Hôtel des Invalides with perfect impunity. Gilbert, after assuring himself that the flesh of a cow had killed several dogs, had some cooked and given to another dog, but it remained unaffected. In the outbreak of

Anthrax that occurred at Las Cruces, New Mexico, in 1865, Smith tells us of an instance in which a diseased goat was killed and eaten by a whole family; but that only the woman who prepared the flesh for the table was affected by the malady.

Similar instances are given by Meyer, Mangin, Goux, and others. The first-named authority has seen seventy people eat the flesh of an ox which had communicated malignant pustule to two butchers, who had slaughtered and dressed it; no harm followed. German and Italian veterinary and medical literature contain numerous examples. In Beauce and other parts of France where the *sang-de-rate* prevails, it is notorious that the shepherds and knackers eat the flesh of sheep which have died or been killed because diseased, and also give the uncooked *débris*, while yet warm, to their dogs; yet no accidents are reported. The peasantry of Posen eat Anthrax flesh with perfect indifference, because they believe it to be harmless when boiled. Braxy mutton is also eaten in this country, and particularly in the Highlands of Scotland; yet accidents are rare.

The Kirghises regularly eat the flesh of horses and cattle which have been affected with Anthrax fever, and which have died or been killed. Unterberger, who lived for eighteen years in the government of Simbirsk, Russia, had never heard of diseased, but cooked, horse-flesh causing any malady to those who consumed it. Even with the uncooked flesh no serious results may follow. Reynal points out that the animals at the Jardin des Plantes are fed upon the flesh of oxen, cows, &c., which have died of Anthrax, without exhibiting any bad consequences. No doubt the same occurs in our own Zoological Gardens, and those of other countries.

Barthélemy caused dogs and pigs to consume such flesh, but could not succeed in producing the disease in them. Renault undertook a long and careful series of experiments, which appeared to establish, beyond a doubt, that the dog and pig may eat Anthrax flesh without danger. It would, however, appear from his experiments that sheep, goats, and horses were violently affected.

These contradictory facts are not capable of being reconciled at this stage of our knowledge of the disease. It may be that the difference in the intensity or virulence of the malady affects its readiness of transmissibility when received into the stomach, as it does its inoculability. Some forms of the malady are not nearly so virulent as others; neither is the poison elaborated in some species so energetic as in others. It is sufficient to know that serious consequences to mankind and animals have resulted from consuming such flesh as food, and that cooking and roasting cannot always be relied upon to destroy the virus.

If, therefore, certain facts tend to prove that in numerous instances the flesh of animals which have succumbed to anthracoid maladies has been utilized as food, without any serious consequences, there are others which equally demonstrate that this impunity cannot always be anticipated; and that, in order to guard against dangerous results, the sale of such flesh should be interdicted. In those cases in which it must of necessity be utilized as food, the diseased animal, if killed, should be thoroughly bled, and only the muscles, after these have been deprived of as much blood as possible, kept for use. If required for early consumption, they should be cut into small portions, and exposed for a long time to a high temperature in the process of cooking. If not required so soon, the flesh should be steeped in a strong brine, which ought to be frequently renewed; or it ought to be thoroughly smoked for a considerable period, the same care being exercised in cooking it.*

* "Braxy mutton" is thus preserved, previous to being consumed, in the Highlands of Scotland. But the practice is very old. The venerable Fleta, in perhaps one of the oldest treatises on agriculture written in this country (*De Pastoribus*), mentions the disease as occurring among sheep towards the months of August and September, through the carelessness of the shepherd, corrupt pastures, the destructive properties of a certain cloud which appears about that time, or a white covering on the grass (hoar frost?). The sick, he recommends, are to be immediately separated from the healthy. The carcasses of those which have died he describes as being steeped in water from the ninth hour until evening, and afterwards hung up to drain; the flesh, being subsequently salted and dried, was given to the farm labourers and their families.

With regard to the recognition of the flesh of animals which have been affected with Anthrax, it must be remarked that it is not at all unusual to kill such creatures when they first exhibit symptoms of the disease, dress the carcass, and hurry it off to the nearest market; for it does not keep long, and soon becomes putrid, thereby increasing the danger to those who do not know its history, and who may not only have to handle, but to eat it.

From what we have said as to the necroscopical appearances in this disease, there is no difficulty in arriving at a decision if the animal is not dressed, and still retains its internal organs. The characteristic alterations will then be readily recognized.

But when the carcass has been dressed and prepared for sale, it is difficult, though not impossible perhaps, to arrive at a satisfactory conclusion. The blood which may yet remain in some vessels, offers the alterations already enumerated; the adjacent textures are stained, and a microscopical examination may result in the discovery of bacteridia—the veins also form dark-coloured plexuses. The flesh is generally, though not always in less acute cases, of a very deep-red, or reddish-brown colour, the tint becoming darker as it is older; it is soft and friable, as if cooked, and readily reduced to pulp between the fingers. In the muscular interstices, especially in those of the loins, there are frequently patches of ecchymoses and gelatinous masses, and on the surface of the muscles we have the citrine-coloured infiltrations of the connective tissue. Ecchymosed patches are also observed beneath the pleura and peritoneum, and in and on the texture of the heart; the lymphatic glands of certain portions, as well as the kidneys, are nearly always gorged with blood, and much more friable than usual. The yellow and brown infiltrations and exudations, with the characteristic staining and extravasation, are distinct evidences of the malady.

Such flesh, as has been stated, readily putrefies; foul-smelling gases are often disengaged from its surface, and these render its serum frothy.

It should be stated that the flesh of overdriven, fatigued,

or highly excited animals presents certain alterations quite analogous to those of Anthrax; the blood is black, pitch-like, and does not coagulate; it stains the fingers; the flesh is impregnated with a blood-tinted serosity, and congestion of vessels is observed in various tissues; the muscles are readily detached from the bones, and putrefaction soon sets in.

Van Hertsen recommends that such flesh should be attentively watched for eighteen to twenty-four hours, before its consumption is allowed.

USE OF THE MILK OF ANIMALS AFFECTED WITH ANTHRAX.

It must seldom occur that the milk of animals affected with this disease is consumed as nutriment, as in sudden and rapid attacks the secretion of this fluid is quickly suspended; or if it continues for a certain period, it is so promptly altered in its physical qualities that its appearance alone should lead to its condemnation. It is of a dirty bluish colour, streaked with blood, and soon becomes putrid.

The examples of its pernicious effects are not numerous. Gohier mentions that he has known a case in which a man was attacked with severe Diarrhœa, from consuming the milk of a cow affected with Anthrax. He has also witnessed the same occurrence in a family of five persons. Morris reports a similar occurrence. Chisholm gives the case of a girl, three years old, who presented all the symptoms of Anthrax from drinking the milk of a diseased cow. Desplas has given some instances, noted during an epizoöty of Anthrax at Quercy, in which the malady was transmitted to other creatures by the milk.

In the so-called "Hog Cholera," sucking-pigs die in great numbers when the sows are infected.

THE SPLENIC OR TEXAS FEVER OF CATTLE.

I HAVE hitherto said nothing of that evidently peculiar form of Anthrax, known on the American continent as the "Splenic, Texas, or Spanish fever," which has been observed wherever and whenever cattle from the States on the Gulf of Mexico have been driven northwards during the summer months. Although it has been recently carefully investigated by Professor Gamgee (see the "Report of the Commissioner of Agriculture on the Diseases of Cattle in the United States," published at Washington in 1871), we have yet much to learn concerning it. As it is not at all improbable that cattle from the Gulf of Mexico may find their market in this country, a brief notice of the disease will not be out of place in a work which aims at defining these contagious maladies, and suggesting measures for their prevention. In 1868, the destruction it wrought among the Northern herds with which the travelled Texan droves came into contact, and the mysterious character of the disease, caused a serious panic, and nearly led to the total suppression of the traffic in cattle between the States on the Gulf of Mexico—almost entirely cattle-rearing countries—and the Northern States. If the different reports hitherto published are to be relied upon as strictly accurate, this form of Anthrax presents some striking differences in its contagious and other properties, to those we are familiar with on the European continent; though so far as the necroscopical appearances are described and delineated in the excellent report just alluded to, it is undoubtedly a blood-disease like Anthrax. I cannot discover, however, whether the blood has been examined microscopically; there is no allusion to it in the reports, nor yet are there any experimental researches recorded. The following recapitulation of all the information obtained up to 1870, gives an outline of the most salient features of the disease:—

1. The malady is communicated by Southern cattle.

2. The cattle communicating the infection, though showing signs of splenic enlargement or evidence of once existing disease, when slaughtered, are apparently well and actually increasing in weight and vigour. (While Southern cattle possess the germs of virulent disease, it is rarely, if ever, developed in themselves, at least with the same manifestations and intensity. As prisoners coming from unventilated gaols have communicated Typhus to judge and jury, without active manifestations of similar disease in themselves, so Texas cattle, coming from miasmatic pasturage, infect cattle of other climates, and cause a disease, unknown in degree, or perhaps in kind, among the stock in which the infection originates.)

3. Infection is not usually communicated in winter; and fields may be safely depastured in spring which have been occupied in winter by Southern cattle. In a single case reported, an apparent exception occurred.

4. Animals receiving the infection from Southern cattle do not communicate it to other natives. This exemption is a rule so undeviating, that probably not one farmer in a hundred whose stock has suffered by this disease, would fear a dollars' loss by communication of his uninfected with sick animals. The authenticated exception occurred at Hamptonburg, New York; and in that no positive proof is given that the animal communicating the infection was not a Texan. (The evidence of an important witness, and which was generally corroborated, was: "My own experience, and all the authentic information I have been able to obtain, goes to show and prove most conclusively that in the most aggravated cases of the disease among native cattle, and where they are dying by scores, and other native cattle are in a field or enclosure at a proper distance from any point that may have been infected by Texas cattle, you may drive native cattle, sick with this disease, into the field with the native cattle in good health, and not one of the healthy cattle will ever be infected or sick with the disease." And the New York Commissioners, in their report of 1868 on the malady, say: "We have not heard of a single case of the disease having been taken by any animal that has

not been in contact with Texas cattle or with their excretions. We have had authentic evidence that Texas cattle that have passed over a road, dropping the excrement thereon, have communicated the disease to native cattle that passed over the same road forty-eight hours afterwards.")

5. Southern cattle removed to localities characterized by the same climatic conditions (as from one portion of the Gulf coast to another, or upon the same parallel of latitude), do not communicate disease to local stock.

6. The virus appears to be eliminated from the system after a stay of a few weeks or months in a Northern climate; so that no infection is communicated to the cattle with which they come in contact.

7. A preponderance of testimony tends to establish the theory that the infection is conveyed through the voided excrements. It does not appear that the disease has ever been communicated "except to animals that have fed upon pastures or in lots soiled by the excrements of the Southern cattle."

8. The period of incubation is not of uniform length. From causes which it is for medical investigation to determine, the potency of the virus is variable. Sometimes a week intervenes between the exposure and the attack; frequently a period of ten days or two weeks elapses; sometimes two, three, or six weeks intervene; and in one case in Washington County, Arkansas, the time of incubation was three months. In portions of Arkansas, in which the climatic conditions are similar to those of the region from which the migrating cattle come, no infection occurs; and in proportion as a section assimilates in climate to such region, it is reasonable to suppose the liability to the disease is lessened, and, probably, the period of its incubation extended.

9. The disease runs a brief course of a few days, generally but three or four, often but one or two, and proves fatal in nine cases out of every ten.

10. Liability to infection is so imminent that few exposed animals escape. When circumstances favour the greatest virulence of the disease, whole herds have often been destroyed, and the cattle of entire districts nearly all swept away; while

beyond the line of exposure, distinctly marked as the boundary of a sweeping conflagration or resistless tornado, not a herd nor an animal has been touched.

11. Medication has been of little service, though the testimony gives colour to the probability that a slightly reduced mortality might be secured by skilful medical treatment, and feeding with soft mashes.

12. The losses from this disease for a few years prior to the war, and for years since its close, cannot be accurately stated, but undoubtedly amounts to several millions of dollars. The greatest fatality has been in Missouri and Kansas. In 1858 the loss in Vernon County, Missouri, was 200,000 dollars. Losses were widely distributed and severe throughout Southern Kansas and South-west Missouri in 1866 and 1867; in 1868 they were less in these States, as the result of general enforcement of restrictive laws, but were heavy and alarming in Eastern Illinois and Western Indiana, when the prairie pastures of those States were for the first time occupied by cattle direct from Texas. The deaths numbered about 5000 in Champaign County, Illinois; 1500 in Warren, 600 in Benton, and 400 in Jasper, in Indiana; and many counties in these and other States were involved to a less extent. The mortality of 1868 amounted, according to the returns, to at least 15,000 cattle, involving a loss of not less than 500,000 dollars.

13. While meat of diseased animals can never be deemed wholesome food, the milk and flesh of cattle affected with this disease do not generally cause immediate sickness. With regard to the latter part of this statement, one witness reported that 140 head of native cattle died from Texas fever in 1868, on the farms in his charge, and among them nearly all the cows, whose milk was used with impunity until its secretion ceased; the calves sucked as long as their mothers could stand, and in one instance a calf sucked three cows alternately until each died. In some cases the hogs consumed the carcasses of dead cattle; and yet there did not occur any accident from the use of this flesh and milk.

It appears, and with good reason, to be looked upon as a climatic disease, and the opinion seems to be that it can never

involve in general destruction the cattle of the country by successive generations of the virus, as in the case of the Rinderpest and other contagious maladies of that class, and "that its ravages may be easily confined to certain limits, if not prevented altogether by judicious legislation which shall not interfere seriously with the freedom or the profits of the cattle trade."

Professor Gamgee's conclusions are :—

1. That Southern cattle, especially from the Gulf Coast, are affected with a latent or an apparent form of the disease.

2. That they become affected in consequence of the nature of the soil and vegetation on which they are fed, and the water which they drink.

3. That their systems are charged with poisonous principles which accumulate in the bodies of acclimatized animals that enjoy an immunity.

4. That Southern cattle may be driven so as to improve in condition ; and yet for some weeks, and probably not less than three months, continue to excrete the deleterious principles which poison the cattle of the States through which the herds are driven on their way north or west.

5. That all breeds of cattle in States north of those of the Gulf Coast, without regard to age or sex, if they feed on grass contaminated by Southern droves, are attacked by the Splenic fever ; that the disease may be, but is very rarely, propagated through the feeding with hay.

6. That the disease occurs mainly during the hot months of summer and autumn, and never after the wild grasses have been killed by frosts, until the mild weather in spring returns ; that the grasses are healthy, and continue healthy, unless fresh droves of Texan or of Florida cattle are driven over the land.

7. That heat and drought aggravate the disease in individual animals.

8. That the Splenic fever does not belong to that vast and deadly group of purely contagious and infectious diseases of which the Rinderpest, the Lung-plague, and Eruptive fevers are typical.

9. That it is an enzoötic, due to local influences, capable of

only a limited spread, and analogous to or identical with the "black water" of various parts of Europe.*

10. That, however warm the weather may be, cattle affected with Splenic fever have not developed in their systems any poison like the Anthrax poison;† and that the flesh, blood, and other tissues of animals are incapable of inducing any disease in man or animals.

11. That Splenic fever is not malignant typhus nor typhoid fever. That it has no analogue among human diseases, but is, however, developed under conditions which prevail where the so-called malaria injuriously affects the human health.

The disease sometimes runs its course rapidly, the first indication of its presence being a dead animal. The earliest suspicious symptom is an increase of temperature.

The ordinary symptoms are drooping of the ears, sluggish gait, and checked secretions.

In cows giving milk, the quantity may be reduced to one half, or even more. At first the animal eats, ruminates occasionally, and its paunch appears full; but soon there is a disposition to lie down; and wherever pools exist, the sick cattle are inclined to lie in the water. In some cases there is cough. The depressed head, drooping ears, arched back, hollow flanks, tendency to draw the hind legs under the belly, and knuckling over at the fetlocks behind, are early and marked symptoms. The skin is dry and rigid; the fæces not usually much altered at first, though in some cases evidence of slight hæmorrhage may be noticed. The visible mucous membranes are rather pale, though a congested condition of the nasal membrane and a discharge of glairy mucus has been seen;

* There, nevertheless, appears to be a wide difference between the Texan fever and what is called "black water," one of the most important distinctions being the infectiousness of the first. Indeed, the points of resemblance between the two maladies appear to be very few.

† There does not appear to be any experimental proof of this. The origin of the disease, the region in which it is engendered, the season in which it appears, the necroscopical appearances in those animals which have perished from it, and the symptoms observed during life, ally it closely to certain forms of Anthrax. Anthrax is a common disease in South America.

the membrane lining the rectum is reddened. The pulse is frequent and small, and becomes imperceptible as death approaches. The temperature varies with the degree of blood extravasation. The breathing is hurried, and often laboured. In some animals—those with great restlessness and tendency to delirium—the respirations have been counted as high as one hundred per minute, and in comatose animals they are slow, deep, and stertorous.

There are marked nervous phenomena, indicated by twitchings and tremblings of the muscles, and in nearly all the cases there is unsteadiness of the posterior extremities in progression, and great difficulty in getting up. Great listlessness and stupor are indications of early death. There is œdema between the branches of the lower jaw, or below the chest. The fæces are stained with blood, and the urine is deeply coloured by that fluid. After death the bladder is found greatly distended.

In the majority of cases, the depression and listlesssness increase, the pulse is more frequent, the respiration more laboured, and the temperature reduced, the animal stretches out on the ground on which it has been lying motionless for some time, and dies without a struggle (Gamgee).

The *post-mortem* appearances are very similar to those already described as present in Anthrax fever.

The preventive and suppressive measures should be the same as those recommended for Anthrax.

Medical treatment has hitherto proved of but little value.

FOWL CHOLERA.

GEOGRAPHICAL DISTRIBUTION.

THIS peculiar, contagious, and fatal malady of poultry has been known for a long time in Europe, and has appeared in recent years on the American continent, where it has on several occasions proved most destructive, killing as many as twenty per cent. of the poultry where it broke out. It has also at various times been prevalent and deadly in India. Its ravages in Europe have been noted from a very early period;* and in France, where it has been carefully studied, it has perhaps proved more destructive than elsewhere. In 1798, it prevailed as a very extensive epizoöty in Lombardy, when it was described by Baronio. Huzard alludes to a serious outbreak in Paris and its suburbs in 1830; and other French veterinary authorities, who have made a careful study of the disease, have thrown much light upon its pathology.

Its coincidence with outbreaks of Asiatic Cholera, as well as its rapid course, have served to procure for it the designation of "fowl cholera." For instance, in 1830 and 1831, the great wave of this human pestilence had crossed the European frontier, and was making its way from the East towards the West, spreading terror and death wherever it appeared. In 1828, the week before the outbreak of Cholera in Madras, Searle reports a great mortality among fowls, the symptoms and pathological appearances being similar to those of Cholera. (At Jessore, India, in 1817, at an early invasion of this disease, Tytler mentions an extensive and sudden loss among poultry.)

* These will be found in chronological detail in "Animal Plagues."

In 1830, often preceding the Cholera, sometimes coinciding with its appearance, this poultry disease showed itself, according to the medical reports, at Tauria and Taganrog, Moscow, Poland, Trieste, Galicia; in 1831, it was prevailing in the government of Tver, Hungary, Moravia, Silesia, Bohemia, Lower Austria, slightly at Berlin and its vicinity, at Leipzic, Hamburg, and Haut-Garonne, France. In 1832, during the height of the Cholera, poultry died in large numbers over nearly the whole of France, Spain, and Italy. At St. Petersburg, the same mortality was noted.

In 1835, it was very destructive in Eastern Prussia; and in that year and 1836, it was as extensive and fatal at Alfort and Toulouse, France, and at Munich. In 1849, it re-appeared with the Cholera, and continued for two years in different parts of France; in the Seine and neighbouring departments, it committed great ravages. In 1851, it was carefully studied in France by Renault, Reynal, and Delafond; and since that period, its invasions have neither been few nor far between. As has been stated, it also severely visits the poultry in America.

CHARACTER.

The disease attacks without distinction, sometimes simultaneously, sometimes successively, all kinds of birds, but chiefly poultry, ducks, turkeys, and geese; Guinea-fowl, pea-fowl, and pigeons are more rarely affected, a circumstance accounted for, perhaps, by their smaller numbers. Sometimes rabbits are affected. With regard to the species first attacked on a farm, it will sometimes be the fowls; in another ducks and geese; and from these it will extend to the others. In other localities it will be most severe in one species—say the fowls—and less so with the geese, ducks, &c.; while, again, elsewhere, the fowls will be exempted, and one or other of these involved.

Age and sex have not any influence on the frequency or severity of the attack; but birds in the best condition are earliest and most severely affected, and succumb quickest. Birds from one to three years old appear to be more disposed

to its invasion than those which are younger or older. It most frequently commences at the beginning of spring, when the laying season begins; or if already in existence, it increases at this time. During the hot summer months, and particularly in stormy weather, the mortality is greatest. The birds generally perish in largest numbers in the roosts during the night. At the outset of the disease, nearly all those attacked succumb; but towards its decline, like all other epizoöties, it is less destructive, less rapid in its course, and a smaller number are affected.

NATURE.

The disease has been described by Baronio as parasitic in its nature, from the large number of worms he found in the intestines; Huzard and Breschet believed it to be Gastro-enteritis; Maillet thought it was an asthenic blood disease; Delafond asserted its identity with Anthrax fever, but it possesses some notable differences; and many authorities are of opinion that it more closely resembles Asiatic Cholera than any other malady. Its frequent coincidence with that terrible pestilence, particularly in its larger invasions; the similarity of many of the symptoms, particularly the prostration; the almost tetanic cramps; at times the coldness of the body; the kind of cyanosis indicated by the violet colour the crest and skin assumes; the Diarrhœa, at first glairy and mucous, then white and often foamy; the convulsive hiccough, sometimes present when death is about to take place; and the rapid and fatal termination; all certainly lend force to this analogy. There is a difference, however, in the physical character of the blood, and that of man has not the same virulency; and the cyanosis, gray dejections, and convulsive movements simulating cramp, are not so constantly present in poultry. Reynal, however, is forced to admit that, if there is not absolute identity, there is at least a close analogy in form and external symptoms between the two maladies.

CAUSES.

The causes of the disease are very obscure, as it appears in all situations, at every season, at all temperatures, and is as severe in the best-kept poultry-yard as in the worst; so that neither régime or hygiène appear to have any influence in its development. Temperature would seem, nevertheless, to affect its intensity, as in the hot months it makes the largest number of victims; while a cooling shower, or the north wind blowing for a brief period, temporarily suspends its ravages; in stormy weather, it breaks out with increased intensity. No satisfactory result has ever been arrived at with regard to the conditions on which its development depends. In the large majority of cases, it appears to break out spontaneously, and without any assignable cause, except that of a contagious kind.

SYMPTOMS.

The invasion and course of the malady are so prompt and rapid, that it is frequently difficult to trace the symptoms; as most frequently the birds are not observed to be ailing until a few minutes before their death. In those cases, however, in which the morbid phenomena have been observed, the following were noted:—The bird is dull, listless, and depressed-looking; sways from side to side, and drags its legs in walking; the wings droop, and the body sinks towards the ground; the feathers are bristling, the head low, and the neck flaccid and drawn back. The bird appears to be destitute of energy, and seldom scratches the ground; it seeks the sun; and when several are ill, they collect and huddle themselves close together. The appetite is in abeyance, and the most tempting food does not provoke it; thirst is increased, and the bird drinks frequently. From the commencement, many fowls have Diarrhœa of a white colour, muco-serous character, and repulsive odour; at first rare and in small quantity, it soon becomes more frequent and abundant, and also changes its character, being then whiter, more clear, often foamy, and sometimes slightly streaked with blood. If the beak is opened,

the mouth will be found full of a sticky matter, mixed, in some cases, with a transparent whitish fluid that flows abundantly from the mouth and nostrils when the animal is suspended by the legs. The crest or comb at this period assumes a darker tint towards its border, is somewhat flaccid, and inclines to one side.

A little later, these symptoms are more marked; the movements are slow, and only take place when the bird is compelled; it does not notice what is passing around it; the comb is darker coloured at its margin, and more flaccid; and when the feathers are separated, the skin is observed to have a slight blue tint in many instances. The prostration is very great, and the bird appears to be asleep; the back is raised; the animal can scarcely stand, and when made to walk it staggers. The eyelids are kept almost constantly closed, the eyes deep sunk in their orbits, and vision evidently imperfect; the body sways backwards or forwards, or from side to side; the wings are apart from the body, and droop on the ground; and the feathers on their summit, as well as on the body, stand upright, and have lost their lustre. The debility increases, and the bird, no longer able to stand, rests with its beak, breast, and wings on the ground. The crest is swollen and drooping, and red, violet, or black in colour. In this condition of prostration and torpor, the creature dies.

With some birds, shortly before death, there are nervous movements; the respiration becomes laboured and convulsive, and shakes the body; at intervals, a harsh, guttural cry is emitted—a kind of hiccough. At the same time the feet and wings are agitated and contorted; a little foamy saliva flows from the beak, a small quantity of white or grayish bubbling fluid is expelled from the anus, and the bird perishes.

In other cases there appear to be no convulsions; and it is not rare to find them dead on the nest, without a straw having been disturbed.

Others, before death, turn round as if attacked with vertigo; in some there is a kind of vomiting of a glairy, yellowish-white fluid; and the Diarrhœa, which is nearly always present,

is either gray, white, yellow, or black in colour, or streaked with blood, but constantly foamy or sparkling.

COURSE AND TERMINATIONS.

The course of the disease is very rapid, death taking place in a few hours, or even a few minutes when it is very intense; but when it is on the decline, it may not occur before twelve, eighteen, or twenty-four hours. Sometimes death occurs without the slightest warning, the birds having been feeding, laying, or crowing only a few moments before. Others are attacked while they are running with the other birds: they suddenly stop, fall as if struck, and die; while others, again, have only appeared to be ill for a few minutes, and, jumping as if galvanized, all at once succumb.

The disease nearly always terminates in death; it is only when the outbreak is declining that a few spontaneous recoveries are noted.

PATHOLOGICAL ANATOMY.

The body becomes cold and rigid soon after death, and the skin preserves its bluish tint, shaded with a dark red; over the crop and abdomen the colour is greenish; the mouth and nostrils are filled with the fluid already described. The flesh is of a pale rose-colour, dry, and odourless. The appearances in the digestive apparatus are the most characteristic and constant. The membrane lining the mouth is pale, and the epidermis on the point of the tongue is white, and so hardened that it comes off in the same manner as in the "pip."

The crop contains a considerable quantity of acid, and sometimes foul-smelling fluid. The intestines are deeply injected, and red-coloured externally; and in the small intestine —chiefly about eight to twelve inches from the gizzard—are found, in different degrees, the most constant alterations. In the mildest cases, this portion of the intestine contains a large amount of mucus, resembling clear soup, and of a dirty-grayish colour; the mucous membrane is covered with a soft, purulent-looking, viscid layer, which is removed by washing in

water or rubbing it gently with the handle of the scalpel, when the exposed membrane is found to have a dull rose-colour, with the villi much congested in irregular patches. In more severe cases, this white matter is more abundant and consistent; and when it is carefully removed, the mucous membrane is seen to be coloured unequally by blood exudation, or speckled with red points—small blood-clots—corresponding to patches of ecchymoses beneath, and slight erosions. In some places the superficial layer of the membrane is destroyed; and in some cases the ulceration is still more marked, the matters contained in the first portion of the small intestine being of a reddish-brown colour, as if composed of mucus, pus, and blood. The velvety appearance of the membrane has disappeared, and is replaced by a fluidy, granular, red surface; while the villi, into which there has been hæmorrhage, are destitute of epithelium, and often cut down to near their base. The matter in the intestines, when examined microscopically, is found to be composed of epithelium, mucus, alimentary matters, and some pus globules. In a somewhat large number of fowls, tape-worm is present. The large intestine usually only shows traces of injection; but the rectum is more or less marked with red and livid patches, or bands, on the margin of the folds.

In some cases, the liver is increased in volume, and may be of a pale-yellow or ochre colour, or a reddish-brown; its texture is softened and friable.

Sometimes the lungs are slightly hepatized, and the pleura covered with exudation. The heart is studded with ecchymosed spots, particularly towards its base; its interior is similarly marked, and the blood is very dark and clotted. This fluid during life does not differ in any respect from normal blood.

The pericardium contains a variable quantity of citron-coloured, limpid fluid. In the cranial cavity, there have only been observed congestion of the vessels and some ecchymotic points.

The blood in the vessels coagulates soon after death, and

forms a firm clot with but little serum, and stains very slightly; otherwise it does not differ from healthy blood.

DIAGNOSIS.

The peculiar symptoms and pathological alterations mentioned above, should be sufficient to distinguish this disease from any other.

CONTAGIUM.

According to Reynal, of all the known contagious diseases, there is none to equal this in the certainty and rapidity with which it can be transmitted to other creatures by its fixed virus. Such is its virulency, that inoculation with the blood of a fowl which is ill, or has died of the malady, will not only produce death in an animal of the same kind, but in one of a different species, in a period varying from eight to sixty hours. The virus appears to be fixed; for though fowls introduced from infected places among healthy ones, as well as food, have been supposed on different occasions to produce the affection, yet the experiments carried out by Renault, Reynal, and Delafond, having for their object the transmission of the disease by cohabitation, and by the effluvia from the *débris* of dead animals, were negative in their results.

Experiments have proved that the virus is present in the blood, bile, spermatic fluid, pericardiac fluid, aqueous humour, lymph, fæces, muco-purulent matters in the mouth, the yolk of the egg, and the scrapings from the muscles—in a word, throughout the entire body. Poultry, pigeons, parrots, and rabbits have been inoculated with these matters, and they have been constantly affected, after a variable period, with the disease.

VITALITY OF THE VIRUS.

The virus appears to be tenacious of its vitality, as blood from a dead fowl was found to be as virulent after having been kept for ninety-six hours, as in the fresh state. Its activity only begins to disappear when the clots, which are usually firm and resisting, lose their cohesion, and become liquefied—

are, in fact, becoming decomposed. Neither do successive transmissions destroy or impair its potency; as the virus is as active, and will as certainly produce the disease, in the fourth generation as the first, and a difference of species does not affect it. In inoculating at first a fowl, then a duck, and successively a goose, parrot, pigeon, and rabbit, and afterwards re-inoculating a fowl with the blood of the last-named creature, this bird died as promptly as if it had been inoculated directly with the blood of the fowl which had primarily furnished the virus.

INFECTION.

The disease is transmissible by inoculation to a large number of animals. It is readily and constantly communicated to fowls in this way; also to pigeons, ducks, geese, parrots, rabbits, dogs, and horses.

MODE OF INFECTION.

Beyond inoculation, we have no direct proof that the malady can be otherwise transmitted; though there appear to be reasons for believing that it may be produced in a natural manner by cohabitation of the diseased with healthy fowls.

MODE OF ACCESS.

Of the manner in which the contagium obtains access, we are in ignorance. Birds, dogs, cats, and pigs have been fed upon the grain from the crop of diseased fowls, as well as the flesh and other parts, and have suffered no inconvenience.

INCUBATION.

The period of incubation varies somewhat. Thus, Reynal abstracted some blood from beneath the wing of three diseased, but living fowls, two hours, five hours, and, in the third, twelve hours before death, and inoculated three healthy fowls with it; these died—the first in twelve hours, the second in fifteen hours, and the third in forty-eight hours. The blood taken from the right cavities of the heart of two fowls which

had been dead two and sixteen hours, caused death in two others in twelve and twenty-two hours.

Pigeons, ducks, geese, and parrots died, on the average, in ten hours after inoculation. Rabbits perished in the same period. Two dogs inoculated with the blood from these died —one in fifty-four hours, the other in seventy-two hours. The blood from the heart of a fowl which had been dead an hour was employed to inoculate a horse suffering from Glanders; death ensued in about forty-eight hours. The blood of the rabbits, dogs, and horses which had succumbed to these inoculations was used to inoculate fowls, pigeons, and parrots beneath the wing; and these perished in between ten and forty-eight hours.

These experiments will afford an idea as to the duration of the incubatory period.

EXTENSION.

We are not acquainted with the circumstances upon which this disease depends for its extension; as neither geographical nor geological conditions, nor yet those of a hygiènic kind, can explain its oftentimes eccentric course and spread. It may prevail widely in a district, and yet not be witnessed in a village in the midst of others which are greatly infected; and in another village, one or more fowl-yards are spared, though surrounded by others in which the disease is causing great havoc. It sometimes even happens that of two habitations, separated only by a wall, and both in apparently the same condition with regard to hygiène, one will be entirely depopulated by the disease, and the other will not lose a fowl.

Reynal remarks that, during the outbreak in France, in 1851, in certain infected farms all the newly-purchased fowls, intended to replace those that had perished, were promptly affected; in others, they escaped; and in others, again, the power of infection was such, that the disease re-appeared in the poultry-yards which had been vacant one, two, and even six months, whenever new fowls were introduced.

MORTALITY AND LOSS.

This is a most fatal disease, as when it first appears nearly all attacked perish. In 1851, Reynal saw the fowls die on some farms at the rate of a hundred a-day, and large poultry establishments were often depopulated in a week. In America, its ravages, though very severe, yet appear to be less serious than in Europe, only twenty per cent. of the fowls succumbing.

IMMUNITY.

We have no evidence to show whether one attack of this "cholera" gives exemption from another; but it would appear that animals in the best condition—*i.e.*, the fattest—are soonest and most seriously affected, and die quickest; and that fowls from one to three years old are most liable to be attacked.

SANITARY MEASURES.

Although there is no experimental proof, beyond inoculation, of the manner in which infection is conveyed, yet there appears to be sufficient evidence to show that, as in the case of Asiatic Cholera, birds from an infected locality often import the contagion. In this way, care should be taken not to introduce new purchases, especially from infected localities. Though hygiènic measures have not hitherto had much influence in checking or preventing the invasion of the disease, yet they must not on that account be neglected. Cleanliness; an abundance of fresh air; shelter from the hot midday sun; good water; a change of food; and exercise, are necessary. Green food, and especially when the birds are allowed to gather it on meadows or lawns, has been found particularly beneficial with the healthy, in ameliorating the effects of the disease when it did appear.

Moving the poultry to another place when the malady breaks out has often succeeded, the strongest and liveliest being emigrated. This measure obviates the effects of overcrowding, which appears to favour the invasion and spread of

the malady. Those which manifest the least sign of disease, should at once be isolated from the others, and kept in a place by themselves. The dead fowls should be buried in the ground, or in the manure-heap. The poultry-yard and roosts should be cleansed and disinfected.

CURATIVE MEASURES.

Curative measures have not been found successful by any of the authorities who have attempted to cure the malady in France. In America, dosing the birds with common salt has been attended with benefit in one outbreak. The internal administration of carbolic acid might be beneficial.

USE OF THE FLESH OF DISEASED FOWLS AS FOOD.

There appears to be no positive harm induced by the consumption of the flesh of diseased fowls as food. Renault and Reynal have fed young dogs and pigs on it, and they did not suffer in any way. Dogs and cats devoured it with impunity. Grognier gives similar testimony. A beggar took away all the fowls which had perished from the natural or inoculated disease at the Alfort Veterinary School, and he and his family of five children consumed them without suffering any inconvenience. Baronio and Grognier likewise mention the fact of dead diseased poultry being used as human food without any harm being reported.

In 1851, when nearly all the farms in the neighbourhood of Paris were suffering from the effects of the disease, the owners and their servants ate fowls which had died or were sacrificed in consequence of the malady, and no evil consequences resulted. Every day such birds were purchased by dealers from the farmers, and sold, either to their customers or in the market; but no evidence as to the injuriousness of this traffic was ever produced.

Even were there proofs that such food is hurtful, it would be difficult to discover the presence of disease in the bodies of the fowls exposed for sale, when properly prepared for the

market. The flesh is firm, white, or of a pale rose-colour, without any trace of extravasation either on or in the muscles, when the fowls have been bled previous to death—which is often done. When bleeding has not been attempted, the flesh is then a little red, but not sufficiently so to enable any one to assert that it is due to disease.

RABIES.*

SYNONYMS—λύσσα (*lyssa*), λύττα (*lytta*), ὕδωρφόβος (*hydrophobia*). *Rabies, Rabies canina, Canis rabiosa, Hygrophobia, Pantephobia, Aërophobia, Cynanthropia, Cynolyssa, Dyscataposis, Phobodipsia, Erethismus hydrophobia, Clonos hydrophobia, Lyssa canina.* English: *Madness, Dog madness.* French: *Rage.* German: *Hundswuth, Tollwuth, Wuthkrankheit, Hundtollheit.* Italian: *Arrabiato, Rabbia.* Spanish: *Rabioso, Mal de rabia.* Flemish: *Razernij, Dolheid, Watervrees.* Danish: *Raseri, Vandskræk.* Swedish: *Raseri, Vattuskræck, Hundsjuka.* Arabic: *M'Kloub, Merd-el-Koulb.*

GEOGRAPHICAL DISTRIBUTION.

Though Rabies is undoubtedly most prevalent in the temperate regions of the world, and incomparably less frequent in the torrid and frigid zones; and though it is altogether unknown in some parts; yet it would appear that the facilities for increased communication with different, and hitherto very remote, quarters of the globe have, of late years, tended much to diffuse and generalize the malady, and to introduce it to countries where, until recently, its terrible presence had not been felt, if we are to credit the reports of careful observers.

The malady is very frequent in Western Europe, and is evidently on the increase. France and Germany, Upper Italy, and Holland, appear to suffer more than any other continental countries, and England is becoming much more frequently visited.† Spain is also sometimes severely scourged

* A complete treatise on this malady (Rabies and Hydrophobia, London, 1872), has been published by me, and to this I must refer the reader for every particular relating to it. The above description is as brief as is compatible with the character of the present work.

† At the present time (October, 1874), we are in the middle of an outbreak which commenced at Wigan and Preston, Lancashire, in 1868, and has extended thence, in every direction, reaching the borders of Scotland,

by it, but it is rare in Portugal; and Scotland and Ireland are much less troubled than England. It is well known in North and South America, having appeared as a terrible epizoöty in Peru and Chili; and it haunts the valley of Copiapo. It is observed in the Brazils from time to time, and breaks out in Mexico now and again; though it is either very rare, or altogether unknown, on the eastern side of the Andes. It has never been heard of in Quito. In the West Indies, in Hispaniola, Jamaica, Domingo, Havana, Guadaloupe, and Hayti, as well as Ceylon, it is frequently witnessed, and it has been introduced, in 1813, into the Mauritius. I have been able to testify to its existence in North and South China, and it has been reported from Cochin China and the kingdom of Annam. It is frequent and fatal in India, and is probably widely diffused over the Asiatic continent. It is by no means rare in Syria and the Holy Land, and Turkey. Travellers have asserted that it prevails in El Hejaz, that part of Arabia bordering on the Red Sea; and in North Africa and Egypt.* It has also been reported in Algeria; but Rholfs asserts that Hydrophobia is unknown in Morocco. Gibraltar and Malta have been seriously visited by Rabies at times, and in Sweden,

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and to London, Kent, Surrey, Sussex, and Wiltshire, causing great loss of human and animal life, as well as panic and inconvenience. Since the annual loss of life from Hydrophobia in England has been recorded, there appears to have been a progressive increase in the number of persons who have fallen victims to it. In 1866, it was twice that of any previous year, thirty-six deaths having been reported; but in 1871, there were no fewer than fifty-six deaths.

* The history of this disease, which is extremely interesting, as well as its geographical distribution, are given in "Rabies and Hydrophobia." With regard to its distribution, recent inquiries have proved that it exists in countries which were not long ago believed to be exempt. For instance, Rabies was said by a number of travellers to be unknown in the East, and particularly in Arabia, not many years since. But we know now that it is by no means rare in that region; and that it is not of recent date we have evidence in a very ancient treatise ("*El Naceri*") on the horse and other domesticated animals—written about seven centuries ago. In this work, the effects of the bite of a rabid dog (*add el-Kalib*) on the horse are well described.

Denmark, Norway, Russia, and Lapland, it has been frequently seen in an epizoötic form ; but it is not yet positively decided whether it exists in the Arctic regions. In my monograph on the malady I have given Kane's description of a disease which killed nearly all his dogs in this part (lat. 70° 41′), and which, in its most prominent features, closely resembled Rabies. Steller and Erman assert that it is unknown in Kamtschatka and Greenland, where it would prove a terrible scourge to the natives, whose existence mainly depends on their sledge-dogs ; but Hayes (" The Open Polar Sea ") gives us the particulars of an outbreak in South Greenland, which persisted for several years, caused him the loss of his sledge-dogs in 1870, and in 1872 had extended from Smith's Sound to Jacobshaven, threatening the utter extinction of the species, and with it the disappearance of the Esquimaux. In all its features it appeared to be Rabies.

It is unknown, according to reliable evidence, in Australia and New Zealand, Van Diemen's Land, the Azores, and St. Helena, as well as the Island of Madeira ; it has not been seen at Sumatra, nor in East, South, and West Africa.

CHARACTER.

This is a virulent disease, developed, primarily, in the canine, feline, vulpine, and some other allied species of carnivorous animals ;* but is communicable by inoculation, not

* Among the feline animals which have been noted as liable to Rabies, may be mentioned the wolf, the fox, hyæna, jackal, racoon, and badger. Dr. Russell, of Lincoln, Massachusetts, United States, reported the death of a boy from Hydrophobia, caused by the bite of a racoon.

A correspondent of " The American Sportsman," writing from Kansas, United States of America, in 1874, says that over a dozen persons in that district died in the previous year from Hydrophobia produced by *skunks'* bites, and he mentions that the symptoms exhibited by the victims were precisely similar to those produced by the bite of a mad dog. A personal friend of his was bitten by one of these animals, and died six weeks afterwards in the greatest agony. The term " rabies mephitica " has been proposed by Hovey (*American Journal of Science* for 1874) for the disease produced by the common skunk (*Mephitis mephitica*) when mad, and which is almost invariably fatal. He gives particulars of forty-one cases occurring in Virginia, Michigan, Illinois, Kansas, Missouri, Colorado, and

only to these, but also to herbivorous, omnivorous, and, indeed, it would appear, to all warm-blooded creatures. The transmission of the disease from one animal to another only certainly takes place through inoculation with the viruliferous fluids; for though there are some cases recorded which might be adduced to prove that it may be conveyed otherwise, yet these must be supplemented by others of a more positive character before we can believe the contagium to be capable of dissemination by the air. The malady is generally characterized by the irresistibly aggressive condition of the affected creatures at a certain stage; they being possessed of an irrepressible desire to act offensively with their natural weapons—dogs and other carnivores with their teeth, herbivores with their hoofs or horns; and birds with their beak—when ever so slightly excited. In the absence of excitement, the malady may run its course without any fit of fury or "madness."

NATURE.

The nature of Rabies is not yet well defined. Beyond the fact that it belongs to the zymotic class of diseases, we cannot say much more. It is evident, however, from the morbid symptoms marking its course, that the virulent element elaborated in the system of the diseased animal, when transferred

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Texas, all of which were fatal except one, and the escape in that instance was due to the speedy adoption of preventive measures. Hovey thinks the symptoms which mark the progress of the disease differ sufficiently in several respects from those of "rabies canina" to warrant the above designation.

In France, recently, a veterinary surgeon was called in to see a dog that had become rabid nine days after receiving a bite from a badger. The inhabitants of the district informed him that the bite of a female badger in rut will produce Rabies; and to prevent their inflicting wounds, they put phosphorus on the forehead of the dogs they send into the burrows, so as to frighten the badgers and deter them from attacking.

In 1872, an officer of the Indian Army was bitten at Lucknow by a jackal, and subsequently died of Hydrophobia. Such cases are far from rare, and the malady often follows the bite of the hyæna in that country.

It may be mentioned that Reynal has been unsuccessful in producing Rabies in rats by inoculating them with the virus, and the disease has never been witnessed in that creature.

to a healthy creature, acts chiefly on the nervous system; its effects being indicated by a general pathological excitability, which is soon followed by paralysis of the muscles of deglutition, then those of mastication, and at last paralysis of the posterior extremities.

It might be defined as a specific virulent disease, in which a contagium or infecting element is generated, which, when transmitted to other creatures by means of a bite or inoculation, is capable of inducing the same pathological disturbance and changes after a variable period of latency; these are produced through the medium of the blood, the brain and spinal cord being more particularly involved, and the poison is, in all probability, thrown off chiefly by means of the salivary glands. The eighth pair of nerves, and branches of the fifth and seventh pairs, are especially affected (in man); the medulla oblongata and cervical portion of the spinal cord appearing to suffer most. The nerves of special sense also participate, and the function of the brain is deranged. The condition of other organs would also indicate an alteration in the constitution of the blood.

CAUSES.

The causes which generate the disease may be said to be unknown; for though various authorities have asserted that particular conditions, which they specify, will produce it, yet we have no incontestable proof that these conditions will, alone, develop the malady. There appears, however, to be a mass of evidence to prove that it may be generated spontaneously in the canine, feline, vulpine, and some other species of the carnivora.*

Climate has not, from the evidence before us, much influence in the development of the disease, as will be seen from our geographical notice. It is known in the hottest as in the coldest regions; though some temperate countries are more severely scourged than those of extreme temperature, and

* This evidence, together with a full examination of the causes supposed to operate in producing the disease, are given in "Rabies and Hydrophobia," p. 85.

there are remarkable exceptions even in all these. Season has also little to do with its production, especially hot weather; indeed, it has been ascertained, from carefully compiled statistics, that cases of Rabies are as frequent in the spring and autumn as in the summer, and that the malady may prevail in any season, and in any kind of weather.*

Hunger, thirst, and food will not produce it, neither does the sex appear to have much influence. It has been supposed to be provoked by abstention from coition in the dog, but it is prevalent in countries where the animal lives as a "pariah," and where there is no hindrance to the exercise of the generative functions;† and bitches have been found to be as suscep-

* The statistics which prove this will be found in "Rabies and Hydrophobia." Dr. Russell has ascertained that in the United States of America, 671 cases of Rabies occurred in spring, 580 in summer, 583 in autumn, and 573 in winter. These figures do not differ much, so far as season is concerned, from those published concerning the disease in Europe.

† Leblanc, the eminent Parisian veterinary surgeon, brings forward many facts in favour of the influence of the generative functions in producing the malady, in an elaborate thesis, read by him before the French Academy of Medicine in 1873, and which is published in the "Recueil de Méd. Vétérinaire" for that year. Other facts tending to prove the spontaneous development of the malady from continued excitation of the generative functions in the male dog, and from other causes, are given in the same journal for 1874. Will the bite of an angry dog produce Rabies in other animals, or Hydrophobia in man? This is an important, nay serious, question, and one which is duly considered in my monograph on the malady. Quite recently, however, it has acquired renewed interest from the occurrence of three cases of hydrophobia—one in New York and two in Yorkshire (*Lancet*, October 10, 1874)—said to have been caused by wounds from dogs which were in a healthy condition, and remained so. In "Rabies and Hydrophobia" I have cited a number of cases of a similar kind, and others are recorded elsewhere. But it cannot be denied that none, nor all, of these cases conclusively decide the question, for in all there is the element of doubt with regard to the evidence; some of the cases being more or less of a mere hearsay character, and quite unreliable. And it must be observed that the three cases just mentioned occurred when and where Rabies was particularly prevalent among dogs, and had caused much damage. If the bite of a healthy dog induced the disease, it would be as common as it is now rare, and be as well-known in Australia, New Zealand, and other regions where it has never been witnessed, as it is in Europe. Fighting dogs would also soon become extinct; whereas they are

tible to inoculation as dogs. It is also unknown in such countries as Australia and New Zealand, where this supposed cause must also be in operation as much as in Europe. Anger and pain have also been alluded to as a determining cause, with no better proof; so has breed, though it must be admitted that the malady is more frequent among highly domesticated animals than those which are semi-savage.

So that, in reality, we know nothing of the causes which primarily lead to the development of the malady.

If there are doubts justly entertained as to the power exercised by different influences in the production of Rabies, there can be none with regard to its appearance after inoculation.

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at present, of all breeds, the one which is least affected. If there was any good foundation for such a surmise, it would become necessary to exterminate the entire canine race; for the domesticated dog would be a more terrible enemy to the human species than any creature on the face of the globe. Besides, such a circumstance as a healthy dog inoculating with the virus of a specific malady is so far beyond anything we know with regard to contagious diseases, that until we have the very clearest proof we must remain sceptical, and adhere to our opinion that no wound, injury, or bite from a healthy dog will produce the specific disease we term "Rabies." Of the overwhelming evidence upon which this opinion is founded, we will only give one instance. In 1862, when Rabies appeared as an epizoöty at Vienna, 552 dogs were brought for examination to the Veterinary Institute, and all these, with the exception of thirty-two, were found to be free from this disease; among the remaining 490 were only a few cases of mange and epilepsy. Yet the official report stated that nearly all of these had bitten people, and, notwithstanding, not one of those who had been wounded by the 490 non-rabid dogs died of Hydrophobia. Only one individual—a boy—who had been bitten in the face by a dog suffering from furious Rabies, died in Vienna.

"Since 1848," says Professor Pillwax, of the Vienna Veterinary Institute, "during which period I have had the examination of suspected and really rabid animals, 300 and 400 dogs have been brought every year to the Institute, because they had bitten people. Until the condition of these dogs was ascertained, they were considered suspected by the authorities. Although the number of these non-rabid animals now amounts to more than 5,000, yet not one of the persons so injured by them has had Hydrophobia. If the bite of a non-rabid dog is capable of inducing Hydrophobia, surely a large number of these people must have been affected, and have perished."

Its contagiousness in this respect has been recognized from the very earliest times; and it is now definitely established that it is the only evident, efficient, and incontestable cause at work in effecting the extension of the disease when once developed.

SYMPTOMS.

The symptoms of Rabies in the different creatures affected, are marked by some striking peculiarities, which give a particularly distinctive character to the malady; while the symptoms themselves, in whatever species of animal they may be manifested, bear the same general features, in each being eminently characteristic of the affection: the only differences being due to the dissimilarity in organization, nature, and habits of the various species—dissimilarities which more or less influence the development and course of the symptoms in every disease. A knowledge of these symptoms, especially in the dog, is of the greatest importance; as on it will depend the detection of Rabies in its early stage, and the prevention of the most serious consequences, as well as the avoidance of needless alarm.

DOG.

There is no very appreciable difference between the symptoms in dogs in which the disease has been transmitted by inoculation, and those in which it is believed to be spontaneously developed. The only distinction worthy of notice is one which is sometimes dependent upon the condition of the wound in communicated Rabies; there being oftentimes a tendency to rub, scratch, or even gnaw the spot where the inoculation was made.

The disease has been divided into three stages or periods, and has also been described as appearing in at least two forms, according to the peculiarities of the symptoms.

But, as a rule, one period of the disease does not pass suddenly into another, the transition being almost imperceptible; and the forms do not differ essentially from each other, but appear merely to constitute varieties of the same disease, due

to the natural disposition of the animal, or other modifying circumstances. These forms have been designated "true" or "furious" Rabies (*rage vrai, rasendi wuth*), and "dumb" Rabies (*rage mue, stille wuth*).

The malady does not commence with fury and madness, but the first or initial symptoms are related to the habits of the dog. These are anomalous and strange, a change being noted in the aspect, behaviour, and external characteristics of the animal. It becomes dull, gloomy, and taciturn; seeks to isolate itself in out-of-the-way places, retiring beneath chairs and in odd corners, quite different to its previous lively and sociable habits. But in its retirement it cannot rest; it is uneasy and fidgety, and no sooner has it lain down, than suddenly it jumps up in an agitated manner, walks hither and thither several times, again lies down and assumes a sleeping attitude, but has only maintained it for a few minutes, when it is once more moving about. Then it retires to its obscure corner, to the furthest recess it can find, and huddles itself up into a heap, with its head concealed beneath its chest and fore-paws. This state of continual agitation and inquietude is in striking contrast with its ordinary habits, and should therefore receive attention.

Not unfrequently there are a few moments when the creature appears more lively than usual, and displays an extraordinary amount of affection. Sometimes there is a disposition to gather up foreign bodies—such as straw, thread, bits of wood, &c.—which are industriously carried away. A tendency to lick anything cold—as iron, stones, &c.—is also observed in many instances, and there is also a desire evinced to lick other animals. Sexual excitement is also frequently an early symptom.

At this period, no disposition to bite is observed; the animal is docile with its master and obeys his voice, though not so readily as before, nor with the same pleased countenance. There is something strange in the expression of its face, and the voice of its owner can scarcely cause it to be changed from a sullen gloominess to its usual animated aspect.

These symptoms gradually become more marked; the restlessness and agitation increase. If on straw, the dog scatters and pulls it about with its paws; and if in a room, it scratches and tumbles the cushions or rugs on which it usually lies. It is incessantly on the move, rambling about, scratching the ground, sniffing in corners and at the doors, as if on the scent or seeking for something. It indulges in strange movements, as if affected by some mental influences or a prey to hallucinations, its mind being evidently haunted by phantoms and horrid fancies. When not excited by any external influence, it will remain for a brief period perfectly still and attentive, as if watching something, or following the movements of some creature on the wall; then it will suddenly dart forward and snap at the vacant air, as if pursuing some annoying object, or endeavouring to seize a fly. At another time, it throws itself, yelling and furious, against the wall, as if it heard threatening voices on the other side, or it was bent on attacking an enemy. Though apparently so furious, the animal is yet docile and submissive; for its master's voice will rouse it out of the frenzy.

Though not furious and savage to those around it, yet the saliva is virulent, and the excessive affection which it evinces at intervals, by licking the hands or face of those it loves, renders the danger very great should there be a wound or abrasion. Until a late period in the disease, the master's voice has a powerful influence over the animal, the sentiment of submission and attachment remaining superior to the rabid instinct, even in the height of a fit. When the dog has escaped from all control, and wanders erratically abroad, ferocious and restless, and haunted by horrid phantoms, the familiar voice yet exerts its influence.

Instances are recorded in which dogs, in the first stage of the disease, have lived in their masters' house, moved about without restriction, slept in the room, and even on the bed, without attempting to injure any of the family. It may be this affection which impels the rabid dog, when suddenly seized with a paroxysm, to fly from its home; as it is rare indeed that it attacks its master.

So benignant do the symptoms appear at this stage, and so likely are they to be misunderstood, that a distinguished veterinary surgeon (Bouley) says, "Distrust a dog when it commences to be unwell; every sick dog should, as a rule, be suspected. More particularly distrust a dog when it becomes dull, morose, and seeks solitude; which appears not to know where to rest; which is always on the move, prowling, snapping at the air, and suddenly barking at nothing, and when all around is perfectly still; whose countenance is sombre, and only assumes its usual animated appearance by brief starts. Beware of the dog that is always seeking and scraping, and exhibits aggressive movements against phantoms; and, finally, beware above all of the dog which has become too fond of you, and is continually endeavouring to lick your hands and face."

There is no dread of water in the rabid dog. Water does not inspire it with fear or horror, neither does it produce aversion; from the commencement to the termination of the disease, there is no antipathy to water. The popular notion, due to ignorance, that there is dread of this fluid, has been productive of the most serious consequences in innumerable instances, and has not the slightest foundation to warrant it. So far from there being a fear of water, the animal is generally thirsty, and if water be offered, will lap it with avidity, and swallow it at the commencement of the disease. And when, at a later period, the constriction about the throat—symptomatic of the disease—renders swallowing difficult, the dog will none the less endeavour to drink, and the lappings are as frequent and prolonged as deglutition becomes impossible. Even then we see the poor creature, in despair, plunge the whole of its muzzle into the vessel, and gulp at the water; as if determined to overcome the convulsive closure of its throat by forcing down the fluid.

So little dread has the rabid dog of water, that it will ford streams and swim rivers; and when in the ferocious stage, it will even do this in order to attack other creatures on the opposite side. The evidence on this head is overwhelming.*

* The inappropriateness and danger of the term "hydrophobia" should

Therefore beware of a sick dog, even when it drinks with avidity; for an aversion to water does not exist at any period of the disease.

With regard to food: at the commencement of the disease the dog does not usually refuse to eat, and some animals are voracious to an unusual degree. But in a short time the appetite is modified, and the creature becomes fastidious, eating only what it usually has a special predilection for. Soon, however, this gives place to a most characteristic symptom—either the taste becomes extremely depraved, or the dog is compelled to submit to a fatal and imperious desire to bite and ingest everything, for it seizes with its teeth, tears, crushes, and finally swallows, substances which are generally indigestible, and are certainly not alimentary. The litter of its kennel, wool from cushions, carpets, stockings, slippers, wood, grass, earth, stones, glass, horse-dung, even its own fæces and urine, or whatever else may come in its way, are devoured.

At the examination of the body of a dog which has died of Rabies, it is so common to find in the stomach a quantity of dissimilar and strange matters on which the teeth have been exercised, that if there was nothing known of the animal's history, these would be strong evidence of its having been affected with the disease. When a dog, then, is observed to gnaw and eat such like matters, though it exhibits no tendency to bite, it should be suspected.

The mad dog does not foam or slaver at the mouth to any extent at first. The mucus of the mouth is not much increased in quantity, but it soon becomes thicker, viscid, and

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lead to its suppression. Even in man, the only creature in which a fear of water is sometimes present, it is not a pathognomonic symptom, as it is at times witnessed in other diseases. The notion that rabid animals are afraid of water—that they will avoid it, start back and be thrown into convulsions when it is put before them—is only entertained by people who are ignorant of the disease. Though far more dangerous, it is certainly less absurd than the opinion that this is a mental affection. "I hold Hydrophobia to be a purely mental malady. A man may go mad; an inferior animal cannot," writes a non-professional correspondent to the *Lancet* of February 28, 1874.

glutinous, and adhering to the angles of the mouth, fauces, and teeth. It is at this period that the thirst is most ardent, and the dog sometimes furiously attempts to detach the saliva with its paws; and if, after a while, it loses its balance in these attempts, and tumbles over, there can no longer be any doubt as to the nature of the malady.

There is another symptom connected with the mouth in that form of the disease named "dumb madness," which has frequently proved deceptive. The lower jaw drops in consequence of paralysis of its muscles, and the mouth remains open. The interior is dry from the air passing continually over it, and assumes a deep-red tint, somewhat masked by patches of dust or earth, which more especially adhere to the upper surface of the tongue, and to the lips. The strange alteration produced in the dog's physiognomy by its constantly open mouth and the dark colour of the interior, is rendered still more remarkable and characteristic by the dull, sad, or dead expression of the animal's eyes.

In this condition the creature is not very dangerous, because generally it cannot bite if it tried—indeed, there does not appear to be much desire to bite in dumb madness; but the saliva is none the less virulent, and accidental inoculations with it, through imprudent handling, will prove as fatal as in the furious form. The mouth should not be touched: numerous deaths having occurred through people thinking the dog had some foreign substance lodged in its throat, and thrusting their fingers down to remove it.

The sensation of tightness which appears to exist at the throat, causes the mad dog to act as if a bone were fixed between its teeth or toward the back of its mouth, and to employ its fore-paws as if to dislodge it. This is a very deceptive symptom, and may prove equally dangerous if caution be not observed.

Vomiting of a blood or chocolate-coloured fluid is witnessed in some cases, and has been supposed to be due to the foreign substances in the stomach, which abrade the lining membrane; this, however, is not correct, as it has been observed in mankind.

The voice of the rabid dog is very peculiar, and so charac-

teristic, that to those acquainted with it nothing more is needed to prove the presence of the disease. It is not even necessary to have heard it frequently; for so strong an impression does it make on the mind, that those who have heard it once or twice never forget its signification. Owing to the alterations taking place in the larynx, the voice soon changes: becoming hoarse, cracked, and stridulous, like that of a child affected with croup—the *voix du coq*, as the French have it. A preliminary bark is made in a somewhat elevated tone, and with open mouth; this is immediately succeeded by five, six, or eight decreasing howls—emitted when the animal is sitting or standing, and always with the nose elevated—which seem to come from the depths of the throat, the jaws not coming together and closing the mouth during such emission, as in the healthy bark. This alteration in the voice is frequently the first observable indication of the malady, and it has something sinister and lugubrious about it.

This sudden and strange alteration in the familiar voice of the dog should at once attract attention, and elicit inquiry. In "dumb madness" the voice is frequently lost from the very commencement—hence the designation.

The sensibility of the mad dog appears to be considerably diminished, and the animal appears to have lost the faculty of expressing the sensations it experiences; it is mute under the infliction of pain, though there can be no doubt that it still has peripheral sensation to some extent. Burning, beating, and wounding produce much less effect than in health, and the animal will even mutilate itself with its teeth.

So that suspicion should always strongly attach to a dog which does not manifest a certain susceptibility to painful impressions, and receives punishment without uttering any cry or complaint. There is also reason for apprehension when a dog bites itself persistently in any part of its body, and does not desist because of the pain it should experience.

A rabid dog is usually very excited at the sight of one of its own species: indeed, this is such a powerful stimulus as to immediately induce a fit of fury; so that it may be said that another dog is the certain reagent which will reveal the

presence of the disease yet latent in the creature we may suspect. This test has been resorted to by Bouley, to dissipate doubts as to the existence of the disease when the diagnosis is otherwise uncertain. As soon as the suspected dog finds itself in the presence of another of its species, if it is really rabid, it at once assumes the aggressive, and, if allowed, will bite furiously. This special excitability of the rabid state is not peculiar to the dog, as all rabid animals manifest the same pugnacity when in the presence of the canine species;—all become excited, exasperated, and furious at the sight of a dog, and attack it with their natural weapons. The horse assaults it with teeth and hoofs; the bull, cow, ram, and goat with their horns,—even the timid sheep, when rabid, so far from exhibiting fear when confronted with a dog, under the influence of the malady loses its natural pusillanimity, becomes the assailant, and butts furiously at the enemy before which, in health, it would have fled in abject terror. This introversion of sentiment is sometimes valuable in diagnosing the malady; it is so common that it may be said to be present in every case of Rabies.

When therefore a dog, contrary to its habits and natural inclination, becomes suddenly aggressive to other dogs, it is time to take precautions.

In the large majority of instances, the dog is inoffensive, in the early period of the disease, to those with whom it is familiar; and in all probability, to avoid injuring them, it flies from its home, and either dies of the malady, is killed as "mad," or returns in a miserable plight and in an advanced stage of the malady, when the desire to bite is irresistible. It is in the early stage that sequestration and suppressive measures are most valuable. The dogs which propagate the disease are usually those that have escaped from their owners.

After two or three days, frequently in about twelve hours, more serious and alarming symptoms appear; ferocious instincts are developed, and the desire to do injury is irrepressible. The animal has an indefinable expression of sombre melancholy and cruelty. The eyes have their pupils dilated, and emit flashes of light when they are not dull and heavy; they always appear so fierce as to produce terror in the beholder;

they are red, and their sensibility to light is increased, and wrinkles which sometimes appear on the forehead add to the repulsive aspect of the animal. If caged, it flies at the spectator, emitting its characteristic howl or bark, and seizing the iron bars with its teeth; and if a stick be thrust before it, this is grasped and gnawn.

This fury is soon succeeded by lassitude, when the animal remains insensible to every excitement. Then all at once it rouses up again, and another paroxysm of fury commences. The first of these paroxysms is usually the most intense, and the fits vary in duration from some hours to a day, and even longer; they are ordinarily briefer in trained and pet dogs than in those which are less domesticated; but in all the remission is so complete after the first paroxysm, that the animals appear to be almost well, if not in perfect health.

During the paroxysms the respirations are hurried and laboured, but they are tranquil during the remissions. There is an increase of temperature, and the pulse is quick and hard.

When the animal is kept in a dark place and not excited, the fits of fury are not observed. Sometimes it is agitated, and wanders here and there in a restless, purposeless manner, turns over its straw, and appears to pursue and bark at phantoms; or it will remain crouching for a short period in a drowsy attitude, and suddenly bound as far as the dimensions of its cage or its chain will permit, barking in its peculiar manner at the same time,—then it will perhaps remain fixed for a few minutes staring strangely at objects and persons with which it used to be perfectly familiar,—at other times it is calm, sleepy and motionless, only moving now and again in a quick nervous manner, but without getting up, as if it were haunted by a disquieting dream. It never becomes really furious or aggressive unless excited by external objects,—the most potent of these, as has been said, being another dog, though, if admitted to its cage it may not at once attack it. The attacked animal rarely retaliates, but usually responds to the bites by acute yells, which contrast strangely with the silent anger of the aggressor, and tries to hide its head with its paws or beneath the straw.

These repeated paroxysms hurry the course of the disease. The secretion and flowing of a large quantity of saliva from the mouth is usually only witnessed in cases in which swallowing has become impossible, the mouth being generally dry. At times the tongue, nose, and whole head appear swollen.

Other dogs frequently shun one which is rabid, as if aware of their danger.

The rabid dog, if lodged in a room or kept in a house, is continually endeavouring to escape, and no sacrifice is too great to obtain liberty.

When it makes its escape, it goes freely forward, as if impelled by some irresistible force: travelling considerable distances in a short time, and perhaps attacking every living creature it meets; preferring dogs, however, to other animals, and these to mankind; cats, sheep, cattle, and horses are particularly liable to be injured. When it attacks, it does so in silence, and never utters a snarl or a cry of anger; should it chance to be hurt in return, it emits no cry or howl of pain.

The degree of ferocity appears to be related to the natural disposition and the training the dog has received. Some dogs, for instance, will only snap or give a slight bite in passing; while others will bite furiously, tearing the objects presented to them, or which they meet in their way, and sometimes with such violence as to injure their mouth and break their teeth, or even their jaws. If chained, they will, in some cases, gnaw the chain until their teeth are worn away and the bones laid bare.

The rabid dog does not continue its progress very long. Exhausted by fatigue and the paroxysms of madness excited in it by the objects it meets, as well as by hunger, thirst, and also, no doubt, by the malady, its limbs soon become feeble; the rate of travelling is lessened, and the walk is unsteady; while its drooping tail, head inclined towards the ground, open mouth, and protruded tongue of a leaden colour or covered with dust, give the distressed creature a very striking and characteristic physiognomy.

In this condition, however, it is much less to be dreaded

than in its early fits of fury. If it is yet bent on attacking, it is only when it meets with anything directly in its track that it seeks to satisfy its rage ; but it is no longer capable or desirous of altering its course or go out of its way to attack an animal or a man not immediately in the path. It is very probable that its fast-failing vision, deadened scent, and generally diminished perception, prevent its being so readily impressed or excited by surrounding objects as it previously was.

To each paroxysm, which is always of short duration, there succeeds a degree of exhaustion as great as the fits have been violent and often repeated. This compels the animal to stop; then it shelters itself in obscure places—frequently in ditches by the roadside—and lies there, in a somnolescent state, for perhaps hours. There is great danger, nevertheless, in disturbing the dog at this period; for when roused from its torpor, it has sometimes sufficient strength to inflict a bite. Many people, and particularly children, have perished from Rabies through having committed such an imprudent act as disturbing a rabid dog in this condition.

This period, which may be termed the second stage, is as variable in its duration as the first; but it rarely exceeds three or four days. The above-described phenomena gradually merge into those of the third, or last, period, when symptoms of paralysis appear, which are promptly followed by death.

During the remission in the paroxysms, these paralytic symptoms are more particularly manifested in the hind limbs, which appear as if they cannot support the animal's weight, and cause it to stagger about; or the lower jaw becomes more or less drooping, leaving the parched mouth partially open. Emaciation rapidly sets in, and the paroxysms diminish in intensity, while the remissions become less marked. The physiognomy assumes a still more sinister and repulsive aspect : the hair is dull and erect ; the flanks are retracted ; the eyes lose their lustre, and are buried in the orbits, the pupil being dilated, and the cornea dull and semi-opaque; very often, even at an early period, the eyes squint, and this adds still more to the terrifying appearance of the poor dog.

The voice, if at all heard, is husky, the breathing laborious, and the pulse hurried and irregular. Gradually the paralysis increases, and the posterior extremities are dragged as if the animal's back were broken, until at length it becomes general, and is then the prelude to death. Or the dog remains lying in a state of stupor, and can only raise itself with difficulty on the fore limbs when it is greatly excited. It this condition it may yet endeavour to bite at objects within its reach. At times, convulsions of a tetanic character appear in certain muscles; at other times these are general. A comatose condition ensues, and the rabid dog, if permitted to die naturally, perishes, in the great majority of cases, from paralysis and asphyxia.

In "dumb madness" there is paralysis of the lower jaw, which imparts a curious and very characteristic physiognomy to the dog; the voice is also lost, and the animal can neither eat nor drink. In this condition the creature remains with its jaw pendent and mouth consequently wide open, showing the flaccid or swollen tongue covered with a brownish matter, and a stringy, gelatinous-looking saliva lying between it and the lower lip, and coating the fauces, which sometimes appear to be inflamed. Though the animal is unable to swallow fluids, the desire to drink is, nevertheless, intense; for the creature will thrust its face into the vessel of water in futile attempts to obtain relief, even until the approach of death. Water may be poured down its throat without inducing a paroxysm. The general physiognomy and demeanour of the poor creature inspire the beholder with pity rather than fear, and almost impels one to afford it assistance.

The symptoms due to cerebral excitement are less marked than in the furious form of the disease; the agitation is not so considerable, and the restlessness, tendency to run away, and desire to bite, are nearly absent; generally the animal is quite passive. Not unfrequently one, or both, eyes squint, and it is only when very much excited that the dog may rarely contrive to close its mouth. Sometimes there is swelling about the pharynx and the neck; when the tongue shares in this complication, it hangs out of the mouth. In certain

cases there is a catarrhal condition of the membrane lining the nasal cavities, larynx, and bronchi ; sometimes the animal testifies to the existence of abdominal pain, and the fæces are then soft or fluid. The other symptoms, such as the rapid exhaustion and emaciation, paralysis of the posterior limbs towards the termination of the disease, as well as the rapidity with which it runs its course, are the same as in the furious form.

The simultaneous occurrence of "furious" and "dumb madness" is frequently observed in packs of foxhounds.

"Dumb madness" differs, then, from the furious type in the paralysis of the lower jaw, which hinders the dog from biting, except in very exceptional circumstances; and also because the ferocious instincts are in abeyance, and there is no tendency to aggression. Nevertheless, there is every reason for circumspection in approaching or handling a dog suffering from this form of Rabies, as its saliva is none the less virulent; and as the peculiar symptom which gives the malady its prenomen is liable to lead the inexperienced to imagine that some foreign body is fixed in the creature's throat, and so induce them to use their fingers for its removal, great danger is incurred.

It has been calculated that from fifteen to twenty per cent. of rabid dogs have this particular form. Puppies and young dogs chiefly have furious Rabies.

These are the symptoms of Rabies in the dog ; but it is not likely, nor is it necessary, that they will all be present in every case. One or more of the most characteristic may be absent now and again, and others may be more or less modified ; but there will always be sufficient evidence of the kind we have adduced to indicate the existence of the malady.

Sex.

In the canine species, the male sex appears to furnish the largest number of cases, French statistics giving from 3 to 5·87 of dogs to 1 of bitches.

Breed.

All breeds of dogs are liable to Rabies, but it is probable

that highly-bred animals, and those which are most artificially reared and maintained, furnish the largest per-centage.

CAT.

The cat is liable to contract Rabies, either spontaneously or by inoculation; though happily it is rarely affected, for a rabid cat is even more terrible and dangerous than the rabid dog. When this animal becomes rabid, its tiger-like nature is thoroughly roused, and its bites are more fatal than those of any other animal, perhaps, except the wolf.

The furious symptoms are preceded by precursory signs, which are not always readily noticed in such an animal. At the commencement it evinces a loss of or depraved appetite, a gloomy dulness, and objectless agitation and restlessness, which is all the more striking, as the creature is in its nature somewhat inclined to sleep, and passes the greater part of its life in repose. There is generally thirst, with a strong tendency to bite, which is also somewhat unusual, as the cat, in a domesticated state, is much more disposed to use its claws than its teeth.

There is, then, reason to be suspicious when a cat, contrary to its ordinary habits, becomes all at once restless, attacks people without being provoked, moves about without an object, has a tendency to keep aloof, and refuses to eat or drink for several days; or when it has a depraved taste and great thirst, and by its attitude and physiognomy testifies that there is something unusual affecting it.

When the furious symptoms of Rabies appear in the cat, its great eyes sparkle with an unnatural light, and express a startling degree of ferocity. When in a cage, there is nothing more terrible; the mouth is partly open and foamy, the back arched, and the tail beating the flanks; the claws are so rigidly protruded as to cause it to walk with difficulty, and they even penetrate the floor, leaving their imprint there. When any one presents himself before it, it flies towards him at a bound, as high as the cage will permit, as if to attack the face; for this always appears to be the region of the body for which the rabid creature has a special predilection when at liberty.

The rabid cat no longer knows its owner. Tamed, rather than thoroughly domesticated, it in this condition reassumes all its ferocious instincts, freely abandoning itself to them. In this, as in so many other respects, the cat differs widely from the dog. The latter is intensely devoted to its master, and finds, in its affection for him, a power sufficiently strong to dominate, for a comparatively long time, the fierce desires that Rabies fatally develops in it; rather than give itself up to them, it will fly from its home, and vent its involuntary rage on any one rather than those it loves. The cat will also leave the domestic roof when rabid; though rather through the promptings of its savage nature than its devotion to its human companions, and will retire to some obscure loft, cave, or out-of-the-way place to die. It often wanders far from home. The claws are more frequently brought into use than the teeth at last; though both are unsparingly employed when the animal is in one of its paroxysms.

As with the dog, the cat soon becomes haggard-looking and emaciated; the voice changes and assumes a special character: it is hoarse, sinister, and so disagreeable that it is not at all unlike the nocturnal serenades of this creature. But the muscles of deglutition are not so much involved as in the dog; paralysis is not long in appearing, and death occurs in from two to four days.*

HORSE.

Rabies, in the animals to which it is transmitted by inoculation, is marked by the same nervous derangement and excitability as in the dog, and many of the symptoms are analogous, and may be referred to the same pathological changes.†

* The symptoms in the fox and wolf are given in "Rabies and Hydrophobia," p. 248. Illustrated cases of the disease, and its particular features in all animals, are also given in detail in that work.

† The symptoms in man are described in "Rabies and Hydrophobia." It may be sufficient here to state that they differ in some important respects from those just enumerated as observed in the dog—differences which have a special significance with regard to the anatomical appearances exhibited in each. This difference has not escaped Benedikt, who alludes to it in his interesting report on the pathological anatomy of the

The disease in the horse is usually indicated by restlessness biting at the seat of injury, as if it itched; changing position frequently; starting suddenly as if frightened; more than usually susceptible to external influences, and very irascible; the eye more sensitive to light, and staring, the pupil, in the majority of cases, being dilated; the ears are moved as if the animal heard strange sounds; and it appears, like the dog, to be the victim of mental hallucinations. Venereal desires, as also in the dog, are heightened in the mare and stallion. Frequent micturition, or attempts to micturate, have been noted in many cases.

As the disease progresses, cutaneous quivering is observed; this is soon followed by convulsions, and loss of appetite, and difficulty in swallowing are not unfrequently noticed. During the paroxysms the animal kicks violently, and bites so furiously at any objects within reach, that sometimes its teeth, and even its jaws are broken. It will also bite its own body. The respiration becomes accelerated, and the voice hoarse and unnatural, and disagreeable. There is rarely any degree of salivation.

The duration of the paroxysms, which are generally excited by the presence of a dog, is variable, and in the remissions the animal more or less regains its faculties, but is weak and

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malady. In man and the dog, the disease generally begins with a restless melancholia, which in the latter passes into furious madness, while in man this is absent. In man illusions and hallucinations take but small share in the symptoms, but in dogs they are a marked feature in the malady. In man, again, there is an extreme degree of hyperæsthesia, with the greatest possible susceptibility for convulsions; in dogs, diffused paralysis (sometimes local paralysis at first, as in "dumb madness"), blunted sensibility, and aphonia are among the earliest and most characteristic symptoms. In the human being there is the most exaggerated reflex excitability in the movements of deglutition, so that not only the raising a glass of water to the mouth, but even the sight of fluids, will induce spasmodic action in these organs; whereas in dogs there is no dread of fluids, and the muscles of deglutition are paralyzed. In man the severest spasms of the respiratory muscles are present—so severe as sometimes to cause asphyxia. Such spasms are not observed in dogs, which generally die from exhaustion or paralysis.

exhausted. The succeeding fits are usually more intense, and the intervals shorter, and the animal rapidly becomes enervated and sinks. Towards the close, paralysis of the hinder extremities ensues, and the horse then ordinarily maintains the recumbent position. From the second to the fourth or sixth day after the appearance of the first symptoms, death usually occurs in a convulsive paroxysm.

COW.

The symptoms in the cow are similar to those in the horse; though sometimes their commencement is very insidious. Loss of, or depraved appetite; prostration; great restlessness; increased excitability; muscular tremblings; saliva flowing almost constantly from the mouth; exaltation of the sexual desires, especially in the bull; difficulty in swallowing; and the manifestation of disagreeable sensations in the wound, as well as hallucinations, are the first indications.

During the paroxysms, the eyes are staring, brilliant, haggard-looking, and injected, and the pupils dilated; the mouth is hot and foamy, and the voice dull and hoarse. The animal is very excited, bellows frequently, agitates its jaws, paws with the fore feet, throwing the earth or litter behind; and it falls down, rolls about, or tries to break away from its fastenings. There are tremblings and twitchings of the muscles; in the cow the secretion of milk is suspended, and frequently there is evinced an aggressive disposition. Rabid bovines strike with their horns—or their forehead if they have no horns—at obstacles in their way, and with such fury that the horns are often fractured, and the forehead a mass of extravasated blood. They do not always, however, seek to strike with their horns, and very rarely do they attempt to bite. They sometimes jump on other cattle in a frenzy, if at large. The appetite is nearly always lost, and rumination suspended; when the appetite continues it is often depraved; the fæces, at first, expelled at long intervals and in small quantity, become, at a later period, liquid, and are often passed involuntarily. At other times, the expulsive efforts are so great that the rectum is everted.

Emaciation becomes extreme, and at length paralysis of the posterior extremities ensues. Then the animal remains recumbent, and perishes in a state of profound coma.

SHEEP.

In sheep the early symptoms of Rabies are diminution of appetite, cessation of rumination, itching of the skin, and exaltation of the sexual desires. There soon ensues agitation; the voice is modified, the eyes staring, with dilated pupils and reddened conjunctivæ, and the nasal secretion is augmented. During the paroxysms, the sheep make unusual jumps, paw with their fore-feet, grind the teeth, and butt with their horns or forehead at other sheep, people, dogs, or any objects within their reach, and bite utensils when they can get hold of them. It is not at all unusual for them to show a disposition to bite people and animals, and the disease has been transmitted by them in this way. The presence or voice of a dog will often make them furious, and they are not at all afraid of attacking that animal. At intervals they emit a kind of dull bellowing. The exacerbations alternate with intervals of quiet; emaciation sets in, and debility and paralysis ensue. The animals are then most frequently recumbent; saliva usually flows from the mouth, large quantities of mucus are discharged from the nostrils, and death usually occurs in a convulsive paroxysm in from the fifth to the eighth day. Rabid sheep have been known to drink blood.

GOAT.

The symptoms of Rabies in the goat are similar to, if not identical with, those observed in sheep. The only difference, perhaps, is in the desire to bite, which is more marked in the goat than in the sheep.

PIG.

When the pig is about to become affected with the disease, the already cicatrized wound usually becomes more sensitive, and the animal may rub or gnaw it until it is raw. There are indications of a general *malaise;* the pig becomes savage,

frightened, and restless; the gaze is fixed, and the pupils widely dilated; the respiration is hurried, and an abundance of saliva streams constantly from the mouth; the voice is husky and emitted in frequently repeated grunts or groans, though sometimes the animal is mute. During the paroxysms, the foamy saliva increases in abundance; the desire to bite is sometimes intense, and the pig not only attacks inanimate bodies, but also animals, including its own species, and likewise mankind. It burrows and hides its head beneath the litter, and jumps about in a fantastic manner, or tries to tear up the ground in order to conceal itself.

These fits are succeeded by intervals of calm, during which, if a sow, the creature will suckle and caress its young even more affectionately than in health.

At a later period, the mouth and snout become dry; the animal rapidly wastes, and paraplegia (paralysis) supervenes. It is not uncommon to see the lower jaw more or less paralyzed, and though there may be indications that the animal suffers from hunger and thirst, yet it cannot swallow.

Sometimes the taste is depraved, and the creature eats all kinds of unusual substances, some of which it had previously gnawed or torn in its fits of fury.

The senses of hearing and seeing are more acute than in health, and the sensibility of the skin is strangely exalted.

POULTRY.

Rabies is developed in poultry as a consequence of bites from rabid animals, or from experimental inoculation. The birds appear to be influenced by the same nervous excitability and restlessness shown in other animals. They seem to labour under similar mental hallucinations; they perform all kinds of frenzied movements; avoid the light if they can find shelter; the voice is husky; and at times they appear to be moved by the same mischievous impulse to bite, which generally marks the course of the disease in the other animals, and forms one of its characteristic features. They jump on other fowls, and fiercely peck them. After some hours of this fighting, they become

exhausted, stagger about, and either perish in convulsions or die paralyzed.*

COURSE AND TERMINATIONS.

The course of Rabies in all animals is rapid, and the termination invariably fatal; for the reported recoveries are so very few as to be scarcely worth taking into consideration. In the dog, death usually occurs in from two to thirteen days; but the majority perish about the fourth, fifth, or sixth day after the manifestation of the morbid symptoms. In the cat, it is from two to four days; cattle, from four to seven days; sheep, five to eight days; and pigs, from the second to the fourth, or even so late as the eighth day.

PATHOLOGICAL ANATOMY.

As in most of the diseases in which the nervous system is largely involved, the pathological alterations discovered after death are not generally at all in proportion to the severity of the symptoms manifested during life. In Rabies, the morbid changes, though in some cases numerous and marked, are yet in others so trivial and variable, that it may be said the disease has no fixed or pathognomonic lesions.

The following may be accepted as the principal lesions noted in necroscopical examinations of the bodies of dogs which have died of Rabies; though it must be mentioned that some of the alterations are less frequent and conspicuous than others, and a few are but rarely observed:—

There is congestion of the brain, particularly at the base, as well as of the spinal cord, and sometimes serous effusion into these organs. Eckel reported cerebral Œdema as most frequent in August, September, and October.

Benedikt, of the Vienna Imperial Veterinary School, availing himself of the long-continued epizoöty of Rabies in and around Vienna, in 1873-74, made numerous preparations of

* A detailed description of the symptoms in rabbits is given in the Appendix to "Rabies and Hydrophobia."

the brain and spinal cord of a number of animals which had been affected with the disease. The pathological changes were studied by making seven separate vertical sections through the hemispheres in dogs; and the alterations were so striking, that Benedikt was of opinion they could only have been overlooked through imperfect methods of investigation.

In the first place, he noted an abnormal distension of the meningeal vessels, and the accumulation around them, and in the meshes of the pia mater, of inflammation corpuscles, together with a nucleolated exudation. This exudation was strongly refractive of light, was colourless, and, under high magnifying powers, was seen to consist of punctiform nuclear substance (granular disintegration). Striking changes were observed in the gray matter of the convolutions, and in various parts of the nervous centres. One of the coarser changes observed was the presence of numerous holes, or spaces, which, when magnified eighty or ninety diameters, were seen to be filled with a material which also refracted light. This mass, under the high powers of the microscope, consisted of a granular or nuclear substance, in which were single hyaloid and colourless corpuscles, of the size of a distended nucleus of a blood-corpuscle. Inflammatory corpuscles were to be seen in both masses. In the larger spaces, nerve-cells were found. Benedikt further describes what he calls a peculiar condition of the hardened brain, especially in the finer sections. The slightest pressure forced out upon the surface shining masses, which, under the microscope, proved to be myelin (colloid ?). These masses were often found lying detached on the surface of the section, and presented a greenish lustre. He states that he has seen the same in the spinal cord of a horse that had suffered from rheumatic tetanus, and that he had regarded it as a softening and chemical alteration of the substance of the spinal cord.

According to Benedikt, the signs of inflammation are not present everywhere in the pia mater, but only in certain parts; and the distribution of these in the gray matter, and in the central white substance, caused him to believe that they threw

a new light upon the nature of the "granular disintegration." He concluded that the pathological process in this disease consists in acute exudative inflammation, with hyaloid degeneration; which doubtless arises from the exudative infiltration of the connective tissue.*

* "Wiener Mediz. Presse" (June, 1874); "London Medical Record" (September 30, 1874).

Similar appearances to those described by Benedikt have been observed in the nervous system of man. For instance, Dr. Allbutt exhibited before the Pathological Society of London, in 1872, a series of microscopical sections from the cerebro-spinal centres of two persons who died from Hydrophobia. The specimens were taken from the cerebral convolutions, and from the central ganglia, medulla oblongata, and spinal cord. Throughout all these centres were found the same morbid conditions, but in different degrees. They were as follows:—1. Evidences of great vascular congestion, with transudation into the surrounding tissues. In all the gray centres the vessels were seen in various degrees of distension, their walls in many cases being obviously thickened; and here and there were seen patches of nuclear proliferation. There was a diminished consistency of some of the parts, particularly of the medulla. This seemed to be due to serous infiltration and soddening, as has been observed in the dog. 2. Hæmorrhages of various sizes. In many places a refracting material was visible outside the vessels, due, apparently, to coagulated fibrinous exudat. 3. Little gaps, caused by the disappearance of nerve-strands, which had passed through the granular disintegration of Clarke.

The parts appeared to be affected in the following order, as regards severity—(1) medulla, (2) spinal cord, (3) cerebral convolutions, and (4) central ganglia. In addition to these alterations in the nervous centres, an enlarged spleen was found in both cases.

Meynert has also made a microscopical examination of the nervous system of two children who died of Hydrophobia. In the first case, the walls of the blood-vessels of the spinal cord, which were distended with blood, were, in places, undergoing amyloid degeneration, and the adventitious tissue of some of them showed nuclear proliferation; a portion of the fibres was surrounded by tumefied, resisting, medullary substance; in places, the latter was in a state of regression or degeneration, and the cylinder-axis had disappeared. These alterations were more conspicuous in the lumbar portion of the cord than elsewhere. In the second case, the connective tissue of the posterior portion of the cord was hypertrophied by an excessive enlargement of the stellate bodies. The vessels were full of blood, and their walls had also partly undergone amyloid degeneration. The nerve-cells of the cortical matter had also undergone partly molecular, and partly sclerotic change.

The pneumogastric and lingual or hypoglossal nerve, and the cervical and thoracic ganglia of the sympathetic system, have sometimes been found in a congested condition.

The muscular system shows congestion, as well as the connective tissue, liver, and kidneys. The lungs are not unfrequently much gorged with blood, as in animals that perish from asphyxia. The spleen is also more or less congested, and frequently enlarged; it is sometimes quite black and pulpy, from extravasation of blood; at times, black salient patches stud its surface, and give it a tuberculated aspect; when these masses are incised, they are found to contain a black grumous blood. The blood in the vessels is pitch-like, and yields little or no clot.

The mucous membranes exhibit, perhaps, the most constant alterations. These are: redness, of more or less intensity; extreme congestion of the vessels; thickening of the membrane, and hæmorrhagic effusion to a greater or less extent on its surface. These hæmorrhagic patches are met with in the membrane lining the digestive organs, particularly in the stomach, where they are most numerous on the folds; in this situation they are veritable extravasations, frequently accompanied by hæmorrhagic erosions. This has been more especially remarked in animals which have died from "dumb madness."

The tongue is frequently discovered to have been wounded by the teeth; it is covered with a brownish mucus, and is

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The spaces or holes observed by Benedikt, were regarded by Meynert as the result of hardening the brain preparatory to examination.

Dr. Hammond, of New York, has recently examined the brain and spinal cord of a man who perished from the disease, and discovered lesions analogous to those described by Allbutt. The cortical substance of the brain was in a state of fatty degeneration; numerous extravasations of blood were found in the medulla; and the nuclei of the pneumogastric, hypoglossal, and spinal accessory nerves were in a condition similar to that existing in the cortical substance of the brain. In the upper part of the spinal cord was observed granular and fatty degeneration of the gray substance and nerve-roots, together with nuclear proliferation of the neuroglia-cells of the white substance.

deeply congested or inflamed, particularly the papillæ, as are also the tonsils and the salivary glands. The mucous membrane lining the air-passages, commencing with the larynx, is in a similar condition; the bronchi often contain a frothy mucus.

In "dumb madness" the upper air-passages are found to be most seriously implicated, particularly the glottis and vocal cords. The tongue, fauces, and larynx are covered with a considerable quantity of tenacious mucus, and the follicles are enlarged.

The contents of the stomach, and also sometimes of the small intestine, are usually abnormal, and this is very noteworthy. We have remarked on the depravity of the appetite during life, the animal devouring all kinds of substances which it does not seek in health, and which are certainly not nutritive. These are generally straw, hay, hair, wood, excrement, string, nails, earth, stones, sand, grass, glass, &c., with the remains of food. If such like matters are found in the stomach of a dog, it may almost with certainty be affirmed that it was rabid; for it is only the depraved taste which characterizes this disease that would impel an animal to swallow such strange substances.

The bladder is frequently empty, and firmly retracted; indeed, so often is this condition present, that some authorities consider it a pathognomonic sign of Rabies. It is not so, however.

Pustules, erosions, and patches of congestion have been noted about or on the tongue; but with regard to the so-called "lyssi," we have no proof that they are often present.

Bruckmüller, of the Vienna Veterinary Institute, remarks that in different outbreaks varying pathological changes are observed. In the Vienna epizoöty of 1868, there was scarcely a case in which extreme congestion of the capillaries of the stomach, and the presence of foreign substances therein, were not noticed; whereas, in other years, these features had not been particularly observed. For a long time enlargement of the spleen was not noted, but in later years it had become somewhat common. In some outbreaks, Œdema of the brain and

Inflammation of the bowels were the chief alterations found; in others, one or other of these conditions would be absent.

Alterations in the brain were observed in 46 per cent. of 375 rabid dogs examined; enlargement of the spleen in only 3 per cent., though lymphatic complications occurred in nearly 20 per cent.; without taking into consideration the presence of foreign substances in the stomach, that organ was found to be involved in disease in 254 cases, or nearly 70 per cent. Indigestible or foreign matters were found in it in 199 instances, or 55 per cent., and inflammation of the organ was noted in 125 cases, or 33 per cent.

This authority had not witnessed the congestion of the salivary glands and surrounding nerves so frequently alluded to by other writers as present in rabid dogs, particularly in this country. None of the alterations above specified he considered to be absolutely characteristic of Rabies, as they are found in other diseases of the dog; yet the most important circumstance to be dwelt upon, he remarks, with reference to this malady, was the condition of the stomach, and finding in it all kinds of extraordinary substances, such as, in country dogs, leaves, grass, and grass-roots, and in other dogs, leather, rags, &c.; but the presence of these, he asserts, is no certain criterion of Rabies, as they are found, though very rarely indeed, in other than rabid dogs.

The conclusion Bruckmüller arrived at, was that the evidence furnished by dissection alone proves no certain value in distinguishing or defining the disease. By the diversity in the *post-mortem* appearances, it must always be a most difficult matter to decide whether an animal was really rabid; and this difficulty is increased from the circumstance, that all suspected animals are generally killed at an early stage of the disease. Only is there certainty when the history of the animal is known, and when the symptoms during life have been noted. "In practice, however, I hold it as certain that a dog which has not been under observation during life, and about which nothing is known, even though it may have bitten other creatures, has yet not been rabid if the stomach is well filled with food, or the small intestines contain a considerable amount of

chyme; and, on the other hand, it may be asserted, independent of other evidence, that if indigestible or foreign substances are found in the stomach, and the lining membrane of that organ is highly congested and exhibits erosions, that the animal was rabid. With stray dogs, I consider the presence of Rabies established if the appearance of typhus, or a highly inflamed state of the bowels, accompanied with numerous worms in the intestinal canal, be noted. In the other domesticated animals the necroscopic appearances alone are not reliable."*

Rudnew † has studied, microscopically, the principal organs of dogs which had died or been killed when diseased, and is convinced that Rabies, like all other infectious maladies, is accompanied by serious lesions in the most important viscera; so that, relying solely on *post-mortem* examinations, he believes it possible to make a retrospective diagnosis in the majority of cases. He, however, only insists on the alterations observed in the kidneys. These consist in an advanced degree of parenchymatous inflammation; with the peculiar feature, that the alteration in the epithelium of the uriniferous tubes extends in a general manner throughout the organ—in the cortical tissue as well as in the pyramids. This lesion is characterized by a regressive degeneration, which terminates in the complete disappearance of the epithelium, and the repletion of the uriniferous tubes by regressive granulo-adipose masses.‡

In none of his examinations has Rudnew found this alteration absent, and he remarks that in an animal in which the lesions are in an advanced stage, death must have been near. These changes greatly resemble those which accompany, and, indeed, produce, uræmia; and Rudnew thought it very probable

* Lehrbuch de Pathologischen Zootomie der Hausthiere. Vienna, 1869, 2nd part, p. 274.

† Journal de la Soc. des Sciences Médicales, &c. Brussels, 1872.

‡ Similar changes have been noted in man. See "Rabies and Hydrophobia," p. 295. Landowzy, however, has often observed them to be absent in the human subject.

that the various symptomatological occurrences characteristic of Rabies during life are of an uræmic nature.

The blood is as frequently of a bright-red colour, with a trace of a coagulum, as it is a very thick dull-coloured fluid, rich in white corpuscles, and forming clots on the valves of the vessels. In by far the majority of instances, it forms a soft, spongy clot, as is usual among dogs; and only in those cases in which other signs of Typhus were present has it been found dark-coloured, sticky, though not clotty, and without the presence of the characteristic bacteria. It is generally thin, fluid, very sticky, of a dark-red colour, and without any tendency to coagulation—similar in appearance to that which it offers in narcotic poisoning. Its appearance is most constant in those animals in which Rabies has been induced by inoculation, or by the bite of a rabid creature.

Hallier states that the blood of a dog which had died of "dumb rabies" looked as if all the corpuscles had been changed into an adipose mass, largely mixed as they were with fat granules and cells, and containing as they did particles of the same material. Among them were also disseminated many pointed crystals. The blood also contained an extraordinary quantity of minute immovable micrococci, either isolated or in groups. The micrococci could be cultivated and transformed into a fungus, to which Hallier gave the name of *Lyssophyton.*

DIAGNOSIS.

The diagnosis of Rabies in the different domesticated animals is of great importance; and though to the experienced there is not usually much difficulty in deciding as to the presence of the disease, yet, nevertheless, those not familiar with its symptoms frequently mistake it for other maladies, and *vice versâ.* The following are the chief diseases or conditions with which it is confounded in the dog:—

"Epilepsy," in which there are sudden convulsive fits, with loss of consciousness, and accompanied by a flow of foamy saliva from the mouth; at the same time the animal may emit cries of distress, and lie struggling on the ground. There is

very rarely any serious attempt to bite, though the dog champs with its jaws; immediately the fit is over, there is a return to consciousness, and the creature appears to be perfectly recovered. There is nothing like this in Rabies—no loss of consciousness, no convulsive struggles on the ground, and meaningless champings with the jaws; in a word, there are no fits of epilepsy in Rabies.

"Angina" or sore throat, in which all the symptoms of Rabies are absent, except the difficulty in swallowing, and much sensibility on pressure about the upper part of the throat.

"Inflammation of the stomach and bowels" may easily be distinguished from Rabies by the presence of fever, vomiting, abdominal pain, and the absence of nervous symptoms, as well as the peculiar attitudes assumed.

"Colic" does not at all present the same symptoms as Rabies. The dog cries from pain while the spasms last, and very rarely at this period it is so irritable as to be disposed to bite, though not intentionally. The animal retires, and never barks or howls as in Rabies; the moans or yells it emits are those of pain, and only given out at uncertain intervals.*

"Distemper," the specific catarrhal fever of the dog, and its *sequelæ*, might be mistaken for Rabies by the uninitiated. There is frequently a discharge from the nose and eyes in the latter disease as in the former, and this is particularly apt to mislead. Paralysis, also, of the posterior extremities occurs sometimes as a result of the former, and in very rare cases the appetite may be depraved. But otherwise there is a wide difference. The history of the case is important; the commencement of Distemper by sneezing and coughing, the thin watery discharge from the nose and eyes, becoming eventually purulent, the corner of the eyes also suffering from ulceration; the fever, the disinclination to move or rove about, the opposite of which is so marked in Rabies; the absence of irritability and desire to bite other animals or people; the lassitude, debility, and emaciation attending this malady; the comparative slowness with which it is developed and runs its course; and

* The distinguishing symptoms between Rabies and that peculiar disease, "plica polonica," are fully enumerated in "Rabies and Hydrophobia," p. 238.

the unfrequency of a depraved appetite, are all so many distinguishing features.

The nervous symptoms which sometimes supervene upon the more acute ones, have at times been mistaken by the inexperienced for those of Rabies ; but to any one who has paid attention to the diseases of dogs, such a mistake could scarcely occur. We have already alluded to Epilepsy, which is sometimes a sequel of "distemper."

"Retention of urine" has been said to give rise to symptoms which are popularly supposed to belong to Rabies ; but I have had no experience of this condition in the dog, and believe that it must be exceedingly rare.

"Foreign bodies in the mouth and throat" have frequently given rise to symptoms which, in a few respects, simulate those of Rabies. The animal may refuse food and water, have a great difficulty in swallowing, the voice may be altered, and anxiety and restlessness may be present. But the foreign body can be generally felt or seen, and there is usually abundant salivation. The creature in nearly every case makes continual attempts to remove the obstacle with its paws ; there is cough and expulsive efforts which are almost continuous, and the dog is quite conscious. The extreme agitation and furious delirium are absent, as well as the other notable signs of Rabies; and the symptoms vanish as soon as the body is removed. In these cases, however, care must be exercised in examining the animal ; this should be done by an expert, or by a person whose hands are protected by strong gloves, and who will adopt other necessary precautions. In describing the symptoms of Rabies, we have alluded to the need there is for this circumspection.

"Tetanus" is a rare malady in the dog, and can scarcely be mistaken for Rabies. There are rigid and most painful muscular spasms, and the dog does not manifest any inclination to do mischief ; the body is contorted during the spasm, and the jaws usually firmly fixed against each other.

The presence of worms (*Pentastomata tænioïdes*) in the frontal sinuses, or of a very large number of worms (*Tænia echinococcus*) adhering by their hooks to the lining membrane

of the small intestine, may also occasion the manifestation of symptoms analogous to those of Rabies; but there are other characteristic signs of that disease which are absent. Worms in the nose or sinuses of the head will often cause the dog to rub its face incessantly with its paws, against the ground, wall, posts, &c.

The pain and itching consequent on inflammation and ulceration of the internal part of the ear ("canker"), may occasion symptoms which some people might mistake for those of Rabies. The ear of the dog is not unfrequently bitten by rabid animals, and when the disease is about to appear, it sometimes happens that intense pruritis occurs in the wound or cicatrix, the creature rubbing it against everything and trying to scratch it with its paws; but in Rabies, when attempting this it generally tumbles over, and there are, besides, the other symptoms to guide one in forming an opinion. In disease of the ear we have the symptoms continuing for weeks, and even months, and no material change in the habits of the animal; and from the manner in which it carries its head to one side, and the information a cursory inspection of the ear affords, a mistake would be unpardonable.

To distinguish Rabies from all other diseases, the peculiarities exhibited during its course should be constantly kept in remembrance, more especially the nervous and mental phenomena—the altered habit, great anxiety, restlessness, irritability and hallucinations, even while the disease has made but little progress; also the peculiar bark or howl, tendency to rove, depraved appetite, readiness to bite, and with a purpose, the subsequent paralytic symptoms, and the difficulty in swallowing.

The evidence furnished by a necroscopical examination may also go far towards dispelling any doubts that may have existed during the lifetime of the animal.*

* For the diagnosis in the other animals and man, also the analogies and dissimilarities between the disease and Anthrax, *see* "Rabies and Hydrophobia."

CONTAGIUM.

It is an ascertained fact that the contagium of Rabies is present at the commencement of the malady, and until the termination of life; but we know nothing whatever as to its intimate nature or composition, except that it is organic matter in a peculiar condition, capable, like the viruliferous principles of some other contagious diseases, of reproduction in all creatures; and giving rise in them to the same specific effects as were observed in the animal in which it was originally elaborated. We can only judge of its presence by the results so induced.

This contagium is "fixed," and is not transmissible through the medium of the air, breath, &c., surrounding the diseased creatures. It must be noted, however, that some outbreaks would point to the virus being also at times "volatile," and future observations may prove it to be so; in the meantime, all experimental tentatives have only demonstrated it to be in the fixed state.

It exists in its most potent condition in the saliva or mucus of the mouth. From the very earliest period in the history of medicine this has been known; and there can be no doubt whatever as to this secretion being the agent in transmitting the malady in nearly every case of communicated Rabies.

Eckel, of Vienna, and Lafosse, have been successful in producing the disease by inoculating with the blood of diseased goats, hogs, and dogs. The experiments of Breschet, Majendie, Dupuytren, and Renault, however, have not been attended with the same results, though they also transfused the blood of rabid to healthy dogs.

The evidence as to its existence in the flesh of diseased animals is rather conflicting, but the bulk of it is against such a supposition. Schœnkius, Lanzoni, of Ferrara, Fernelius, and others, speak of the evil effects induced by eating the cooked flesh of rabid animals.* With regard to raw flesh, Gohier asserts that he induced Rabies in dogs by feeding them

* Their evidence, and some instances in favour of this mode of transmission, are given in "Rabies and Hydrophobia," pages 36, 127.

on this food, and Lafosse thinks he succeeded in one case. Delafond, of the Alfort Veterinary School, has not been successful, neither have Decroix and Bourrel in their own persons.

Reynal has seen the flesh of cows and heifers that were rabid, used with impunity as food; and Roucher informs us that the Arabs, in Algeria, are in the habit of eating, without repugnance or danger, the flesh of animals which have died of confirmed Rabies; the only precaution they adopt, according to Dussourt and Bergot, is to carefully avoid being wounded by splinters of bone when cutting up the carcass. Renault has inserted pieces of fresh flesh beneath the skin of healthy animals without producing Rabies; and he has also given this flesh to dogs, sheep, and horses, with the same result.

The same amount of conflicting evidence has been offered with regard to the milk. Soranus, of Ephesus, Balthazar Timæus, Faber, and Dussourt, give instances of injurious results following the use of the milk obtained from rabid creatures;* but Andray, Gellé, Baumgarten, Valentin, and Baudot, offer stronger evidence in the opposite direction.

At the Alfort Veterinary School, a ewe which had been wounded by a rabid dog, was soon after delivered of twin lambs, which it of course suckled. Twenty-one days after the infliction of the bite, the ewe became rabid and died, but the lambs remained healthy. Renault collected a large number of facts, which give the following conclusions: Young dogs have lived a long time on the milk of bitches in which the disease was latent or developed, and remained under observation for a year afterwards, without showing any symptoms of the disease. A young goat lived for twenty days on the milk of its dam, in which the disease was incubating, and was suckled during the first three days after the development of the malady; Renault kept it for two years afterwards without perceiving it to be in the slightest degree indisposed during the whole of that interval. Several people drank,

* These instances and others, as well as the evidence to the contrary, are given in "Rabies and Hydrophobia," page 131.

within a variable period after being drawn from the teat, and without any preparation, the milk of cows, goats, and sheep, bitten by mad dogs, and which had been milked until the first symptoms of the disease were observed; notwithstanding the dread they experienced when they learned this, they did not suffer any inconvenience.

Reynal's observations confirm those of Renault.

There is no sufficiently reliable evidence that the contagium exists in the nerves, perspiration, or breath; though instances have been noted in this country which might be adduced to prove that it is present in the pulmonary and other exhalations. Röll states that, in addition to the blood and saliva, the other products of secretion and excretion are equally charged with it.

The evidence is also contradictory as to whether the deleterious principle is present as an infecting agent during the incubatory period of the disease. But pending the settlement of the question by careful observation or experiment, it will be well to remember that Glanders may be induced by means of the blood abstracted from an animal which has been inoculated, but which has not yet shown any external symptom of the disease.

The potency of this contagium would appear to vary not only in certain animals, but in different outbreaks of Rabies. It would also seem that this potency is impaired by passing through several bodies. The experiments of Rey would go to prove that repeated transmissions attenuate its virulency; as he found by successive inoculations in several different animals with rabific virus obtained from one source, that it acted much less promptly on the last than the first inoculated, and that with sheep it had no effect after the fifth removal or transmission. It would also appear that the first bites of a mad dog are more dangerous than subsequent ones: especially if they are numerous, and inflicted at short intervals.

VITALITY OF THE VIRUS.

It is probable that the tenacity or vitality of the virus of Rabies is feeble, and that it does not preserve its potency very

long after the death of the rabid animal; observations and experiments having proved that the malady cannot be induced in man, mammifers, or birds, by the usual media, later than twenty-four hours after that event, or after the *rigor mortis* has completely invaded the body. According to Hertwig, the infecting principle loses its power within from twenty-four to forty-eight hours—when the body has become quite cold and rigid—in the flesh and blood of dogs that have succumbed to the disease; but the period is longer in large animals. In America, Dr. Spalding successfully inoculated a dog with the saliva obtained from one that had died rabid twenty-four hours previously. A pupil at the Copenhagen Veterinary School, in examining the carcass of a dog that had perished from Rabies the previous evening, accidentally inoculated his finger, and he died of the malady six weeks afterwards.

Eckel inoculated with the blood of a man who had died two days before, but with a negative result. He also experimented on a large scale with the saliva and blood of rabid dogs which had been dead for more than twenty-four hours, but without success.

Ménecier, of Marseilles, as the result of his experiments, states that not only is the flesh of rabid animals quite innocuous after death, but that the saliva loses its potency soon after it leaves the animal.

Count Salm inoculated animals with the dried saliva of a rabid dog—though how long the saliva had been collected is not mentioned—and produced Rabies in them. Haubner, however, asserts that there is no proof of the virulency of dried saliva.

Mr. Trevalyan stated, some years ago, that after losing one pack of hounds from Rabies, he not only removed the straw, but had the benches scalded with boiling water, and afterwards all the joints, cracks, &c., painted over and filled up with hot tar. Thus secure, as he thought, he collected another pack; yet Rabies broke out year after year, so that at last the pavement, tainted with the secretions, was removed, and the earth in which it was imbedded thrown into the river; the

kennels were then new painted and whitewashed, and ever afterwards the pack was free from infection.

Little reliance can be placed upon the statements concerning fatal inoculations occurring a long time after the death of the infected creature.

INFECTION.

By far the most frequent mode of infection is that which we have designated "direct"—by inoculation through the instrumentality of the teeth of the rabid creature; "indirect" infection is rare. We have already mentioned that almost every animal is susceptible of the disease by inoculation.

MODE OF ACCESS.

The most certain and common mode of access of the contagium of Rabies is by a wound or sore, the most dangerous injuries being those which bleed least; or by an abrasion on any part of the body. There is not the same certainty with regard to the absorption of the contagium by other channels; though many indisputable facts prove the possibility of such an occurrence. The thin mucous membrane of the mouth, nose, and eyes, would appear to be a ready channel. Enaux and Chaussier mention cases of persons who became infected through wiping the mouth and nose with handkerchiefs soiled with the saliva of rabid creatures; and other authorities have given similar instances of transmission. Bardsley gives the case of a man who, while asleep, was licked about the mouth by a rabid dog, and afterwards died of the disease. Another man was attacked by the malady, and no proof could be adduced that he had been bitten; it was subsequently remembered that he had employed his teeth to untie the rope with which a rabid dog had been hanged.

Two of the fatal cases included in Boudin's table (given in "Rabies and Hydrophobia") were due to small dogs accustomed to lick the face of their owners. Lawrence mentions the case of a lady who had a French poodle, of which she was very fond, and which she was in the habit of allowing to lick her face. She had a small pimple on her chin, the top of

which she had rubbed off, and the dog, becoming rabid, through this channel inoculated her, and she died. A wool-comber in Derby died of Rabies, having become fatally infected in removing the skin of a mad dog and casually putting the knife in his mouth. Lipscomb mentions the case of a poor man in Kent, who became affected through allowing a dog to lick an ulcer on his leg, having been persuaded of the sanative influence of that practice.

Youatt asserts that in more than a score of cases of Rabies in the horse, the disease was induced by their stable companions, Dalmatian dogs, licking them about the nose; but we may suspect that bites were inflicted in these instances.*

This mode of infection by licking renders the danger to persons all the more urgent, as rabid animals, in the early stage of the disease, are much disposed to it.

The unbroken skin of the hands would appear to be perfectly impervious to the poison, as there is no mention of any ill-consequences befalling any of the many veterinary surgeons who have handled the bodies of diseased animals, either alive or dead, and who must oftentimes have had saliva and blood smeared upon their hands.

We have already alluded to the innocuousness of the flesh and milk of rabid creatures when introduced into the stomach; and the result of experiments made to discover whether the virus could infect by this channel has been negative. Hertwig gave a number of dogs the saliva and blood of rabid animals for a certain time without producing any ill effects; he also put five of them into kennels where mad dogs had been kept, put the collars of these upon their neck, attached

* These and other instances are enumerated in "Rabies and Hydrophobia." One of the most recent, however, is the following: "A native boy, the son of the Zemindar of Arnee, has died of Hydrophobia under rather curious circumstances. He had, it appears, a little dog that went mad, and was destroyed. Some time after he was taken ill, and a European doctor was called in who pronounced the case one of Hydrophobia, and beyond cure. The boy, however, had never been bitten by the dog, but his friends subsequently remembered that he had suffered from an eruption on the hand, caused by the dog licking it."—*The Pioneer*, Allahabad, September 30, 1872.

them by the same chains, made them lie upon the same straw, &c., yet none became rabid. Renault has given to dogs, sheep, and horses, saliva alone or mixed with food, buccal mucus, blood and flesh obtained from living dogs or herbivores affected with the malady, or which had died from it, without producing Rabies. Ménecier, of Marseilles, has also arrived at the same result in his experiments. It is doubtful, nevertheless, whether the gastric fluid destroys the potency of the virus, as it certainly does not affect that of Glanders; and Zincke, of Jena, inoculated a fowl with virulent saliva, mixed with some of the gastric fluid of a cat, and it perished fourteen days afterwards.

Wounds inflicted through clothing, wool, hair, &c., are much less dangerous than those made on the unprotected skin —as on the face or hands.

INCUBATION.

The poison of Rabies having obtained access by a wound, an abrasion of surface, or through a very thin but intact membrane, gives rise to particular pathological manifestations after a very variable period of time; according, it would appear, to the predisposition of the inoculated creature, the activity of the virus, and other influencing circumstances.

Perhaps in no other disease is the latent stage more variable and uncertain.* In many cases it cannot be ascertained with any degree of probability, as animals are frequently wounded by others without any particular notice being taken of the circumstance, and also as frequently without any one observing the injuries. It is common to hear the owners of rabid dogs assert that their animals had never been from

* Virchow is of opinion that the contagium has an action similar to that of ferments, and that the new elements introduced at the point of inoculation are continually carried into the blood, by means of which they act on the nervous system. He also says that, in the latent period, the contagium would be eliminated from the blood during the course of the regulating metamorphic movements, did not the elements of which it is composed accumulate in excessive quantity—as may perhaps occur in consequence of the exaggerated multiplication of the ferment when a new inflammation is set up in the wound—and thus produce the disease.

home, or, if abroad, had never left them for a moment; that they could not, therefore, be bitten without their knowledge, and they were not cognizant of such an occurrence; while others do not deny that their animals were bitten, but they do not know when, where, nor how.

In the dog, Lafosse states that the shortest authenticated period he knew was seven, and the longest 155 days. Röll gives from three to six, and rarely from seven to ten weeks. Blaine states that the majority of cases occur between the third and seventh weeks, though some are protracted to three, four, or even a greater number of months. A week was the shortest period he had noted.

Youatt has known instances in which the first symptoms have only become manifest after five to seven months, and never knew of a case occurring before seventeen days. Other authorities have related cases in which the malady was developed within from three to ten days after inoculation. Of nine cases which Peuch could rely upon, the symptoms appeared after 10, 15, 18, 22, 24, 26, 35, 88, and 95 days.

Renault reports that in sixty-eight cases, experimentally or accidentally inoculated, the latent period was from five to 118 days, the largest number occurring between the twenty-fifth and fiftieth day. Saint-Cyr, in eighty-seven confirmed cases, could only ascertain the date of inoculation of twenty-six; in these the latent period was from sixteen to 115 days. Bouley has known instances in which it was only twelve days and as long as seven months, though these were rare; the period was usually from six to twelve weeks.

According to Haubner, in 200 cases, the appearance of the disease within two months occurred in eighty-three per cent.; three months, sixteen per cent.; four months, one per cent. He mentions an instance in which the incubatory period was from seven to eight months, and another in which it was fourteen months. He gives an average of three months. I have, in "Rabies and Hydrophobia," given several well-authenticated instances, in which the interval was over twelve months.

From all the statistics collected with regard to the incubation of Rabies in the dog, we cannot pronounce with certainty

as to when an animal that has been bitten by one which is rabid may be considered safe from an attack of the disease within twelve months; though the evidence would tend to show that after six months the risk is not great.

In young dogs, the incubatory period is shorter than in old ones.

In the cat, the latent period is said to be from two to four weeks.

In the horse, it varies from fifteen days to more than two months, according to Röll; other authorities state that Rabies does not appear in this animal before nine weeks have elapsed. Blaine was of opinion that the average period is the same as in the dog. Youatt speaks of a case occurring four months after inoculation.

Haubner, in forty cases, gives the latent period in the horse after an interval of three months, as occurring in fifteen per cent.; of these, in fifteen it extended to nine months, and one even to fifteen months. Peyronie gives a minimum of fifteen, and a maximum of seventy-four days; and Lafosse speaks of seventy-two, and even ninety-two days' incubation. A case occurred at Lyons of a horse that was bitten in the nose on the 25th March, 1869, by a rabid bull-dog. The wound was cauterized in an hour and a-half after the infliction of the injury; but Rabies appeared on May 30th.

Bouley refers to the case of four horses admitted to the Alfort Veterinary School in 1862, in which the disease showed itself from eight to twelve weeks after they were bitten. Boudin mentions an instance in which a mad dog bit a man, three horses, a cow, and three pigs, in July, 1849, all of which were successively affected with the disease in the course of the year, with the exception of one of the horses, in which it did not appear until September, 1850—an interval of fourteen months.

In the ox, Röll gives the latent stage at from nine days to several months, and even more than a year, according to his authorities. Young animals are usually affected about the third or fourth week after inoculation. Blaine and Youatt believe the period to be much the same as in horses and dogs.

In English veterinary literature, several cases are recorded in which it averaged about two months. In one instance, death occurred within twenty-one days after the wounds had been inflicted.

Haubner, from the statistics of 234 cases, states that ten per cent. occurred after three months; eight per cent. after four months; the last case extending to nine months. He also alludes to instances in which the incubation was prolonged up to the end of a year, fourteen months, and even to two and a-half years.

With regard to the sheep and goat, Vatel has stated the period for the first to be seventy-four days, and Röll gives from several days to some months, but, ordinarily, from two to four weeks. During the epizoöty of Rabies in Lancashire, 1871, a sheep died within fourteen days after the injury. In 180 rabid sheep, Haubner found the latent stage to be over one month in eight per cent.; two months in eighteen per cent.; and up to sixty-eight days in two per cent.

Pigs, according to Haubner, have a latent period of from nine days to several weeks or months, usually of two months. Thorel speaks of forty-nine days, and Gervi declares that he has known it extend to two years. Benion says it never exceeds eight days. I believe that it usually terminates about the fourth week.

Spinola has stated that gestation appears to prolong the period of incubation, and that all the long-delayed cases he knew of occurred in cows in calf; in these the malady did not usually appear until calving-time was over. Doubts may, however, be entertained as to the correctness of this surmise. In Lancashire, in 1869, two cases of Rabies in pregnant heifers were reported. Both animals died—one in twenty-one days after being bitten—without aborting or calving.*

* The incubatory period in man is given in "Rabies and Hydrophobia," page 183.

EXTENSION.

Rabies is capable of a wide extension, owing to its contagious character; but such diffusion is due mainly, if not entirely, to inoculated wounds from diseased animals; and in proportion as rabid dogs and other creatures are permitted to go at large, or to exist without the most rigid sequestration, so will the malady become more frequent, and the opportunities for its spread multiplied.* Like other of the contagious diseases, certain influences of an unknown kind favour the development and extension of Rabies. Some remarkable instances of this are to be found in its history (*see* "Rabies and Hydrophobia"), in which it appeared as a general epizoöty among dogs at one time, foxes at another, and wolves more rarely. Its duration in a country depends upon the measures adopted to suppress it; in some outbreaks it has continued for years.

* Bouley's remarks with regard to the extension of Rabies and the risks incurred through mad dogs at large, are particularly valuable. In the documents forwarded to him for reference, he found that in France, within a given period, the number of dogs bitten was 785, and that out of this number 527 had been killed. Of the 258 remaining, the fate of only twenty-five was reported; these had been sequestrated, and thirteen became rabid. These figures are, however, far from giving an exact estimate of the animals belonging to the canine species which received virulent bites. They only show the number of animals about which the local authorities had received information. Such as they are, nevertheless, they have a signification which it is very important to note. Establish this first fact, that out of the number of dogs which are stated to have been inoculated with the virus, there is nearly one-third—twenty-nine per cent.—that appear to have escaped sequestration or slaughter. Of the twenty-five dogs whose history had been traced and sequestration reported, one-half contracted the disease. Admitting that the same result was produced in the group of 233 dogs allowed to go at large, notwithstanding their being contaminated, it happens that 116 would in their turn become the propagators of this terrible malady; and there is no exaggeration in stating that each of these might successfully inoculate a dozen victims among its own species, each of which could again furnish a new legion of propagating agents, and so on. In this manner Rabies maintains itself, and its increase, in favourable circumstances, goes on at a serious rate.

As has been already stated, there is not yet sufficient evidence to enable us positively to assert that the disease is capable of extension by other means than direct inoculation.

There appears to be a difference in the virulency or intensity of action of the contagium, not only in certain animals, but in different outbreaks. It has frequently been observed that certain rabid dogs have infected the majority of the creatures they have wounded; while others affected with the disease, and equally guilty of biting, have only exceptionally transmitted it to those they attacked. It is necessary to remember this when considering the probabilities of the occurrence or extension of Rabies, and also when endeavouring to draw inferences from statistics. It is also probable that repeated transmissions attenuate the potency of the virus, as already noted.

MORTALITY AND LOSS.

Rabies may be designated the most fatal disease with which we are acquainted, as it all but invariably terminates in death: the very few recoveries on record alone redeeming it from the terrible character of being always mortal. These recoveries, of course, bear no appreciable proportion to the deaths. The loss of animal life in some outbreaks is often serious; cattle, horses, sheep, and valuable dogs frequently falling a sacrifice in large numbers, as in England since 1868. We have no statistics of these losses, but it cannot be doubted that they are on the increase.*

IMMUNITY.

Though so terribly fatal in its termination, every creature inoculated with the virus of Rabies does not contract the disease. Indeed, there appear to be degrees of susceptibility to its action not only among animals of the same, but also among those of different species. This susceptibility is, gene-

* The loss of human life in different countries is shown in "Rabies and Hydrophobia." From statistics compiled by Dr. Russel, it would appear that, in 1873, four persons died of Hydrophobia in New York, and sixty-three in the whole of the United States.

rally speaking, more notable in the canine and feline species than in the herbivora or omnivora. Dogs and cats hold the first place in the scale of susceptibility; then man and the pig; next ruminants—the sheep and goat being more susceptible than the ox; and, lastly, the horse.

Lafosse states that out of sixty animals suspected of having been bitten by rabid creatures, twenty-one died from the disease. According to Renault, of 244 dogs brought to the Alfort school between the years 1827 and 1837, which were bitten in the streets, and subsequently remained for two months under observation without receiving any treatment, seventy-four, or about one-third, became rabid. This authority states that some uncertainty existed with regard to the existence of Rabies in all the dogs which inflicted the wounds; that the traces of bites had not always been sought for and noted in all the dogs left at the school; and, besides, they might have been wounded in parts of the body where the thickness of the hair would prevent the saliva reaching the wound. It was in consequence of this uncertainty that, at different periods between 1830 and 1851, he caused dogs and herbivores—horses and sheep—to be bitten several times, by really rabid dogs, in his presence, and in those parts where the skin is thinnest and has least hair; on other occasions, he obtained saliva from the mouth of the mad dogs when they were most furious, and with it inoculated healthy animals by punctures in the skin. The number thus experimented upon was ninety-nine, of which sixty-seven contracted the malady; the others were kept under observation for more than 100 days without manifesting any symptoms of the disease.

Though everything in these experiments was favourable to the production of the disease, yet it will be observed that only three-fourths became affected; the remaining fourth, without any preventive treatment being adopted, escaping.

Ménecier inoculated twenty-seven dogs with rabific saliva, nineteen of which became affected.

According to the register of the Lyons Veterinary School, the proportion of animals bitten accidentally in the streets, and which afterwards became rabid, was—for dogs one-fifth,

and horses one-fourth. This proportion is not much below that reported by Renault as the result of his experiments. From Berlin, Hertwig reports that, from 1823 to 1837, of 137 dogs bitten in the streets of that city and brought to their veterinary school, only sixteen became rabid—or one to eight. The same talented veterinarian inoculated fifty-nine dogs, of which number fourteen, or 23·7 per cent., contracted the disease; but of twenty-five others which he either inoculated with the saliva of rabid dogs, or caused to be bitten by them experimentally, ten became rabid, and the other fifteen remained healthy. In some instances he found that several inoculations—from two to four—were necessary; and it is worthy of remark that a young mastiff resisted for three years all Hertwig's attempts at inoculation, although seven others inoculated at the same time with the same saliva, succumbed to the malady. It is also recorded that a dog at Charenton, France, escaped the disease after being bitten by a rabid dog; afterwards it was experimentally subjected at various times to the bites of thirty mad dogs, and yet escaped the disease.

Faber has stated that of 114 dogs bitten by others which were rabid, seventy-seven—or sixty-eight per cent.—were afterwards affected; of sixty-eight to seventy-eight cattle bitten by rabid dogs, forty-five—or sixty-four per cent.—died of Rabies; and of 127 sheep, fifty-one—or forty per cent.—became rabid.

Youatt has asserted that two of every three dogs bitten by one that is rabid become mad; that the majority of horses inoculated perish; that one-half the cattle wounded escape; and that not more than one sheep in three becomes affected.

From these statistics, collected in different places and at different times, it might be inferred that at least two-thirds of the animals bitten accidentally by dogs supposed to be, or which are really mad, escape without being submitted to any treatment; while of those experimentally exposed to receive the contagion under the most favourable conditions for its transmission, about one-third do not contract the malady, even when abandoned to their fate.

Lafosse is of opinion that the number of infected varies from one-third to one-eighth. Nevertheless, as Renault has justly

observed, it must not be accepted as correct that these results, obtained in a large number of observations, represent the consequences which might follow the bite of each rabid dog; for it often happens that a dog undoubtedly mad bites a certain number of animals, or furnishes saliva with which to inoculate them, and of this number a sixth or seventh will only contract the disease; while, in consequence of the bites or inoculations with the saliva of another dog which appears to be in the same diseased condition, nearly all the individuals wounded or inoculated—the five-sixths or six-sevenths, for example—will become mad.

It may be as well to mention here, that a mad dog at large, or on its tour of destruction, will frequently bite as many as sixty or seventy other dogs, in addition to the cattle and people it may encounter, and that these wandering rabid dogs are the chief agents in diffusing the malady.

The virus of the rabid wolf, hyæna, and skunk, would appear to be more virulent and prompt in its action than that of the dog.*

SANITARY MEASURES.

PERMANENT PRECAUTIONARY MEASURES.

The precautionary measures which should always be in force in a country liable to be visited by Rabies, are those relating to the numbers and treatment of dogs. The hygiènic treatment of dogs is also very important. They should always be kept in as natural a manner as is compatible with their state of domestication, proper food, exercise and cleanliness being strictly enjoined.

The cruel custom of pampering and overfeeding dogs, and giving them unnatural food, should be particularly guarded against. Nothing can be more reprehensible than keeping dogs confined to the house for days together; or chaining them up for weeks and months to a kennel, without once allowing them their liberty. This treatment is very pernicious

* For immunity in the human species, *see* "Rabies and Hydrophobia," page 144.

to health and temper, and is quite opposed to the animals' natural instincts. All maltreatment of dogs should be repressed.

Dogs ought never to be allowed to run about at large for a long time without being watched, as they are liable to fight with strange dogs, become quarrelsome and vicious, and, driven by hunger and thirst, will eat all kinds of unhealthy food and drink impure water. Quarrelsome and vicious dogs especially should not be permitted to wander, and owners of dogs ought to be held responsible for any damage they may inflict.

One of the first, as it is one of the most beneficial and humane, measures, is the diminution in the number of useless dogs, whose existence is certainly not profitable to mankind; and whose presence, if sometimes a source of pleasure to a few, may yet prove a cause of danger or annoyance to the many. They, besides, must be fed, and their maintenance, if they are numerous, will form no inconsiderable item in the social expenditure—an item, too, which might be more usefully employed.*

* The number of dog licences issued in England, in 1870, was 944,496, and in Scotland 119,471, making a total of 1,063,967; and in the half-year ending 30th June, 1871, the number for England was 951,501, and Scotland 119,671, or a total of 1,071,172. There can scarcely be a doubt that the unlicensed dogs would, at that period, amount to something like one-half the number of those for which duty was paid; and if we estimate the value of the food consumed by each of these animals, at only one penny a day, it will be seen that an enormous sum is expended annually in keeping dogs, of which we may assume that not one-fourth could be classed as useful.

In France, in 1855, there were three millions of dogs, and the cost of keeping them, at an average of seven to eight centimes a-day each, was calculated to be eighty million francs annually. Lavallée, however, gives the expense as greater than this, as he estimates that the daily food of a large dog weighs a kilogramme.

In Austria the number of pleasure dogs (*luxus hunden*) is said to be one million, and the expense of their keep three million gulden; and in Denmark there are a hundred thousand dogs, nearly all of which are useless, while the expense of their keep has been put down at a million thalers.

Boudin has estimated the number of dogs in Europe at more than

In an economical point of view, therefore, the diminution in the number of useless dogs is most desirable; inasmuch as a proportionate quantity of food must be saved for the alimentation of people or useful animals. But from a sanitary point of view, their decrease is even more essential. This decrease may be effected in several ways, but the chief are "taxation," and the "capture," and if need be, "destruction," of all vagrant or stray dogs.

The imposition of a tax upon dogs is generally very effective in diminishing their numbers; the higher the tax, and the more strictly it is imposed upon useless and pleasure dogs, the more probability is there of their becoming fewer.* Sporting or other dogs which are useful and constantly under supervision, may be partially or totally exempted.

With regard to taxing the dogs at a higher rate than the bitches, as has been proposed by some authorities, this would be a judicious measure were it established that the relative scarcity of the latter was an indirect cause of Rabies; but this is not the case, and some facts militate strongly against the acceptance of this theory.

Puppies should be sold, not given away, and all that are not purchased should be destroyed. It is cruel and unwise to breed puppies that they may grow up into half-starved, vagrant, dangerous dogs. As soon as they are weaned, the tax should be demanded; and with all dogs this tax had better be paid half-yearly.

Every dog should wear a collar with a brass plate, on which is inscribed the name and address of its owner, as well as a

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twelve millions, and the price of their food as at least five hundred millions of francs.

In 1872, the "dog crop" of the United States of America was reckoned at 21,000,000 head, and at a moderate computation each was supposed to cost eight dollars a year, making a total of 168,000,000 dollars annually. Still more extraordinary is the statement that upwards of 100,000 of these dogs become mad every year and bite about 10,000 people (*Cleveland-Ohio Leader*, 1872).

* Examples of the benefits attending the imposition of a dog-tax in various countries, are given in "Rabies and Hydrophobia, p. 356.

police register-number stamped thereon, or some particular mark inscribed by the police or inland revenue authorities, as a guarantee that the tax is paid, and for purposes of identification.

All stray dogs without the collar, or which have not the owner's name thereon, ought to be captured, and sold or destroyed, after three or more days, if not reclaimed. If applied for, the owner should pay a fine and all incidental expenses.

Blunting the canine and incisor teeth has also been proposed as a precautionary measure.*

Precautionary measures should not be limited to any fixed period of the year, but ought to remain always in force.

SUPPRESSIVE MEASURES.

The most important point, perhaps, with regard to the prevention and suppression of Rabies is (as with all other contagious maladies) the "vulgarization" of a knowledge of the disease and its symptoms. Provide dog-owners, when they receive their tax-paper, with printed, easily understood instructions as to the proper method of keeping their dogs healthy, and how to detect the early symptoms of Rabies; as well as information respecting the preservative and sanitary police measures which they should comply with, in order to prevent the disease. All this might be printed on the back of the tax-paper, which could, in addition, be made a valuable means of arriving at certain important information, such as the sex, age, breed, &c., of the licensed dogs.† The most serious consequences result from the ignorance of the public on simple matters like this of Rabies.

* For supposed benefits to be derived from, and mode of performing, this operation, see "Rabies and Hydrophobia," p. 360.

† M. Bouley was so impressed with the value of this suggestion, which appeared in "Rabies and Hydrophobia," that he urged its adoption in Paris.

MEASURES TO BE ADOPTED WHEN RABIES HAS APPEARED.

1. *Suspected Animals.*

If morbid or unusual symptoms are manifested by any dog, and particularly if cases of Rabies have occurred in the locality some time previously, it should be carefully observed and every precaution taken; as they may be premonitory signs of the disease, which is contagious from its commencement.

If the symptoms become more striking and suspicious—if it is observed that the animal manifests any of the peculiarities already indicated when describing the symptoms, then it is time to chain it up securely, or confine it in such a manner that no one can be injured by it. Up to this time the owner may be permitted to keep the dog in his establishment, on condition that every security can be, and is, adopted ; but now, and even before this period, if the means for affording this security are insufficient, the owner, or whoever knows of a dog or any other animal to be rabid or in a suspicious condition, must not neglect reporting the circumstance to the local police —indeed, this step should be rendered compulsory, and informers on those who neglect to adopt it should be rewarded.*

* The Austrian Penal Code (387) says : "Is guilty of infraction of the law and liable to imprisonment, whoever knows of a dog or any other animal showing the distinctive symptoms or signs which warrant suspicion of Rabies, and who neglects to report the same to the police. In case of the appearance of the disease, and the wounding of men and animals, the culprit shall be punished with from three days' to three months' imprisonment (*carcere duro*). If a serious wound or the death of any person has been the consequence of this negligence, the infraction shall come under the application of 335, which says : Shall be punished with from one to six months' imprisonment, he who shall be guilty of this negligence, if its consequence has been a serious wound ; the penalty is from six months' or a year's close confinement if the death of any person has been the result. Otherwise, the proprietor is responsible for the damage caused by mad animals."

Rabies was very prevalent in Vienna in the early months of 1874, and caused much alarm. The authorities promptly took action, and issued the following notice : "As repeated cases of canine madness have occurred recently, and many persons have been bitten by mad or suspected dogs,

As, however, the earliest symptoms of Rabies are not always recognized, and the malady sometimes shows itself in an apparently sudden manner; and as, besides, a dog already rabid may escape from its home and reach another locality, the local authorities should be compelled to give warning to the inhabitants, and make known the symptoms of the disease at its commencement and when fully developed. Similar instructions should be given by medical men and veterinary surgeons.

As animals of every kind are liable to be bitten by a mad dog or other rabid creature, or soiled with its saliva, without the owner being aware of it, he should notice carefully every one that becomes unwell, and bear in mind the earliest symptoms, such as unusual excitement, bad temper, and unwonted sulkiness, peculiar hoarse voice (in the dog), viciousness to those about it, and desire to do them injury, &c. If by these manifestations the animal's condition gives rise to suspicion, it ought to be sequestrated and proper precautions adopted.*

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the police direction consider it their duty, in order to prevent more fatal accidents, to direct public attention, and especially that of dog-owners, to the framing of precautionary measures, and also urgently recommend strict obedience to the following order: 'Above all, it is the special duty of the possessors of dogs to pay attention to the management of these animals, and to note any unusual alteration in their manner which might indicate the commencement of the disease—such as an uncommon irritability, impaired appetite, &c., signs which always give rise to suspicion, even if such dogs continue to take water.' Dogs which exhibit such suspicious symptoms should be immediately secured, or carefully conveyed for examination to the Royal Veterinary Institute. The owner, or any other person who knows of a mad or suspicious dog, shall give notice of it to the District Police Commission without delay. Attention is also called to the distinct prohibition of July 23, 1867, against taking dogs in omnibuses and tramway and railway cars where people are assembled; as well as the declaration published on October 15, 1862, containing the unqualified prohibition against taking dogs into public places, such as houses of entertainment, cafés, &c. Furthermore, it is ordered that all dogs shall be led in the streets by a leash; and should any be found at large, they will be seized and destroyed by the public executioner."

In England, at the commencement of the eleventh century, and during the reign of Canute, there was a law by which punishment was awarded to the person whose dog went mad, and by his neglect was allowed to roam about the country.

* All dogs which come within the following conditions may fairly be

If more serious symptoms become manifest, the owner, or whoever is in charge of the animal. should immediately report the case to the local police, to avoid incurring a grave responsibility ; and the animal ought to be at once sacrificed, if, after an inspection by an expert, it is found to be affected with Rabies. If the owner is aware that the animal has been bitten by a rabid creature, then it is still more urgently necessary to report the case to the local authorities.

2. *Rabid Animals or those Wounded by them.*

With regard to the measures to be adopted in the case of mad animals or those wounded by them, the following should be rigorously carried out :—

1. A dog suspected of, or affected with, Rabies, or one that has been bitten by a rabid animal, should not be at once destroyed and buried, unless there is reason to suppose that no person has been wounded by it ;

2. If a person has been bitten by a rabid or suspected animal, it should only be killed if there is proof that the disease is present. If it is only a suspicious case, it is well not to kill it at once, but to keep it securely confined and under close observation, in order to discover the earliest symptoms of the malady. These will not be long in manifesting themselves if Rabies is really present. The creature must then be destroyed and buried ;

3. If a suspected or really rabid dog escapes from its

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looked upon as "suspected :" 1. Those which have been bitten by rabid animals ; 2. Those which have been contaminated in any way with the saliva of rabid creatures ; 3. Those which have eaten the flesh, drunk the blood or the milk of animals affected with Rabies, or which have been soiled by the simple contact of these or other matters, particularly the saliva ; 4. Those which have had sexual connection with suspected animals that shortly afterwards became rabid ; 5. Those bitten by dogs or other animals found dead, and whose bodies, on examination, afford indications of the presence of Rabies ; 6. Those bitten by animals whose furious condition has caused them to be killed, and which, on examination, present these signs independently of those caused by the violent death ; 7. Dogs affected with some vague constitutional disturbance, accompanied by a threatening demeanour, modified voice, &c.

owner, or from any place, or if an animal in this condition is seen in any locality, it is the urgent duty of every one to warn the police immediately. The latter should, in their turn, warn the people in the town or village, or its suburbs, so as to put them on their guard. This warning need not be given in such a manner as to cause alarm and fear, but only to induce the adoption of careful measures and ample precautions. In such circumstances, children should be guarded; and dogs and other animals ought to be confined, and kept from strange dogs, or those whose condition as to health is not certain. All wandering dogs should be confined or killed.

Every means must be adopted, and all precautions duly observed, to capture the mad or suspected animals. If really rabid, it should be killed; but if only suspected, its life may be spared until its condition is ascertained, every precaution being adopted in the meantime to obviate dangerous consequences. This measure, as we have already observed, is all the more necessary if it is not known whether it has wounded people or animals. Even if it is ascertained that it has not done so, and it is not destroyed, it is yet most prudent to keep it under observation until its condition is fully ascertained.

This sequestration demands the greatest care, and, if possible, it should be carried out only in some special establishment—such as a veterinary infirmary. The period during which it should be continued ought not to be less than three or four months,* or even a longer period.

In every case, and under all circumstances, the local authority should take exact note of the occurrences, and especially

* Hertwig gives an instance in which a suspected dog was kept in confinement for twelve weeks, when, showing no symptoms of Rabies, it was liberated. The following week it became rabid.

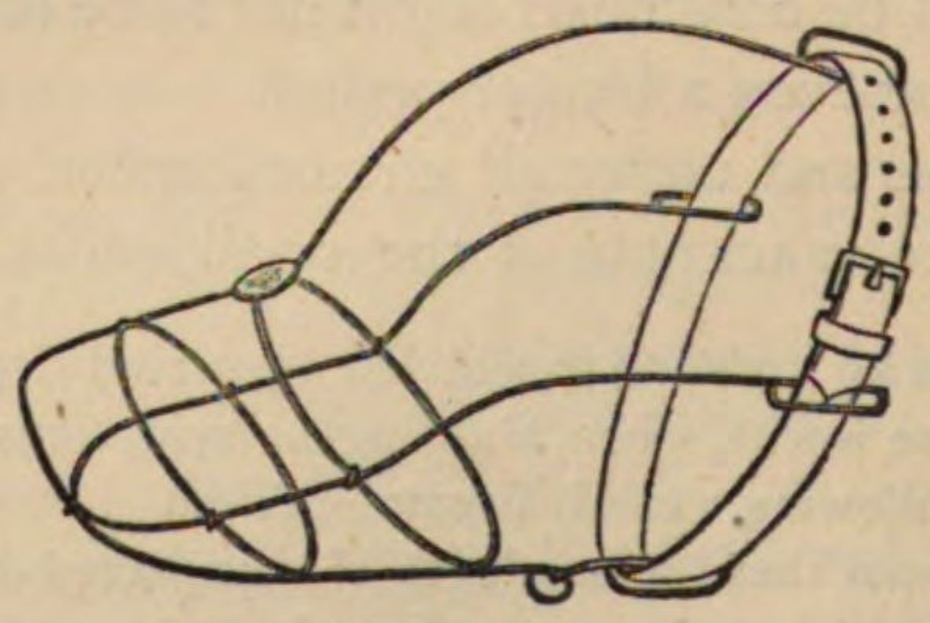
It is most essential that the condition of a suspected dog be ascertained, in order that precautionary measures be adopted in proper time. If, for instance, a dog is killed through being suspected of Rabies, and yet the animal has not been rabid, a great degree of alarm and inconvenience will be needlessly incurred, should the authorities act on the supposition that it was diseased. On the contrary, should there be neglect or delay in destroying a rabid dog, and the creature be allowed to remain at large, a terrible amount of mischief may be the result.

endeavour to discover the domicile and owner of the animal, and whether it has bitten any persons or animals.

When a mad dog appears, the regulations and restrictions should be applied over a wide extent of country, and neighbouring districts should be warned; as it frequently happens that in this disease a dog will run immense distances, especially by night: for it appears to choose this period for its wanderings, oftentimes returning in the morning after having perhaps inflicted wounds on other animals far and near. Besides, the owner might sometimes, and not unnaturally, seek to save his favourite from the operation of the law, and remove it to another district where there are no restrictions. Hence the necessity for extending the suppressive measures over a large expanse of country; for it must be remembered that strange dogs cause most cases of Rabies.

In addition to this, in the announcement made to the inhabitants of the surrounding districts, the country towards which the animal was proceeding, or the direction whence it came, should be made known; as well as a description of the creature with regard to breed, size, colour, and other distinguishing features.

Should the malady become extended, or should there exist apprehensions of its becoming wide-spread, recourse must be had to the muzzle. This article should be worn by every dog



GRAUHAN'S DOG-MUZZLE.

when out of doors, and it ought to fit the head in such a manner that the dog cannot bite while wearing it, or slip it off. A muzzle too small is objectionable, as it may irritate the animal and cause it great discomfort; while one too large may

allow the dog to inflict wounds. The police should see that every dog has a proper-sized and secure muzzle, and any one neglecting to conform to this most important regulation should be punished by a fine. All dogs at large without a muzzle should be captured. The muzzle should be light, of metal (if possible), with plenty of room for the animal to open its mouth to a considerable extent. The best yet proposed is that introduced by Mr. Grauhan, and shown in the accompany-woodcut.

Leading dogs by a leash or chain is no substitute for the muzzle, as powerful animals will break away, even from grown-up people.

3. *Slaughter.*

The destruction of dogs must be carried out assiduously; none should be allowed to go at large, and all stray dogs ought to be captured and, if deemed advisable, killed, should they be without a muzzle. If straying, but wearing a muzzle, they might be detained for three days; and if wearing a collar with the owner's address, they could be returned and a fine imposed. In all cases neglect of sanitary orders should be severely punished.

All dogs bitten by those which are mad or suspected, should be destroyed or sequestered* for a sufficient time, though it is most desirable that those bitten should be destroyed ;† as

* Sequestration can only be carried out properly in a special establishment. In ordinary circumstances, during the first days when every one is filled with alarm at the accident, the dog that has been bitten by one that is suspected or rabid, is submitted to a rigid surveillance ; it is securely tied or shut up, and promises are made that it will be carefully confined and every precaution adopted. But as time passes, the fears entertained gradually subside, and at last so little danger is apprehended that the sequestration is annulled, the dog is set at liberty just at the moment when it is most to be dreaded—towards the expiration of the incubatory period—and the manifestation of the disease is imminent. No one is disturbed by this premature release from confinement of the inoculated dog ; its master, because he no longer believes in the danger ; the inhabitants of the locality, because they have forgotten all about it ; and the authorities, through ignorance of what may occur, neglect their duty, or fear to perform it.

† In destroying dogs, experienced men should be employed, in order that life may be extinguished as promptly and painlessly as possible.

although only some fifty per cent. of those wounded by rabid dogs become affected, yet the value of a dog is too trifling, and the danger too great, to permit any exceptions to be made.

It must always be remembered that dogs which have been in contact with those that are mad, may have been wounded by them, though the wounds cannot easily be discovered ; and as the smallest scratch is sufficient to produce the disease, if it has received the virus, so all animals which have been in communication with the affected ought, to ensure safety, to be considered as suspected. The contumacy of the owner should not be allowed to interfere ; as experience has shown that there is no security except in these severe but effective measures. It is certainly a repugnant proceeding to kill all suspected dogs ; but when we know the dreadful character of Rabies, and the great danger to which animals and mankind are exposed, we can no longer hesitate in prescribing the measure, which in reality is, after all, a humane one.

The only exceptions that might be made would be in those cases in which the wounds were cauterized within a very brief period after their infliction.

DISINFECTION.

All slaughtered dogs should be buried in a place set apart for the purpose, and at a good depth ; the skins should not be removed, and ought to be extensively slashed ; and the bodies should not be thrown into ditches, ponds, or streams, as is so frequently done. Quicklime must be freely used.

All the woodwork, flooring—everything that has been soiled

Much care is necessary in capturing dogs. In general, it will be found that a lasso of wire, catgut, or raw hide, attached to the end of a walking stick, is, with a little practice, very effective ; but the poor creatures should be gently dealt with, and all cruelty ought to be studiously avoided. When captured, they should not be led or dragged along, but if possible put into a covered cart or waggon, with a compartment for each, to prevent fighting ; for if put together in one place, it might happen that a rabid dog was among them, that this might bite many of them, and that some of these might afterwards be claimed by their owners and released. The same observation is applicable to the building in which stray dogs are to be retained.

by the animals in kennels, houses, or stables—should be thoroughly cleansed and disinfected.

DURATION OF REGULATIONS.

No definite rule can be laid down as to the length of time during which the police regulations should remain in force. In Saxony, where the dog laws have been rigidly carried out, it has been found that three months after the last case was sufficient. Notwithstanding the inconvenience and annoyance oftentimes occasioned by the restrictions imposed for so long a period, yet those who suffer most severely from them should remember the great interests there are at stake, and cheerfully aid the authorities in their endeavours to suppress a contagion which causes such terrible mischief and alarm. The more honestly and strictly judiciously-framed veterinary sanitary measures are attended to, the sooner will the course of the outbreak be terminated, and the less will its ravages be felt.*

* The following Act relates to the law with regard to rabid and dangerous dogs in this country.

Dog Act. Chap. 56.

An Act to provide further protection against Dogs. (24th July, 1871.)

Whereas it is expedient that further protection should be provided against dogs : Be it enacted by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same as follows :

Stray Dogs may be Detained and Sold or Destroyed.

1. From and after the passing of this Act, any police officer or constable may take possession of any dog that he has reason to suppose to be savage or dangerous, straying on any highway, and not under the control of any person, and may detain such dogs until the owner has claimed the same, and paid all expenses incurred by reason of such detention.

Where the owner of any dog taken possession of by any constable is known, a letter, stating the fact of such dog having been taken possession of, shall be sent by post or otherwise to the owner at his usual or last known place of abode.

When any dog taken in pursuance of this Act has been detained for three clear days where the owner is not known as aforesaid, or for five clear days where he is so known, without the owner claiming the same, and paying all expenses incurred by its detention, the chief officer of police of

MEASURES TO BE ADOPTED WITH OTHER ANIMALS.

The same regulations are applicable to rabid or suspected cats. They, as a rule, ought to be at once killed, and all other cats and dogs bitten by them should be destroyed.

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the district in which such dog was found may cause such dog to be sold or destroyed.

Any moneys arising from the sale of any dogs in pursuance of this section shall be paid to the account of the local rate, and be applied to the purposes to which that rate is applicable.

All dogs detained under this section shall be properly fed and maintained at the expense of the local rate.

Dangerous Dogs may be Destroyed.

2. Any court of summary jurisdiction may take cognizance of a complaint that a dog is dangerous, and not kept under proper control, and if it appears to the court having cognizance of such complaint that such dog is dangerous, the court may make an order in a summary way, directing the dog to be kept by the owner under proper control or destroyed, and any person failing to comply with such order shall be liable to a penalty not exceeding twenty shillings for every day during which he fails to comply with such order.

Restriction upon Dogs being at large, if danger from Mad Dogs is apprehended.

3. The local authority may, if a mad dog or a dog suspected of being mad is found within their jurisdiction, make, and when made may vary or revoke, an order placing such restrictions as they think expedient on all dogs not under the control of any person during such period as may be prescribed in such order throughout the whole of their jurisdiction, or such part thereof as may be prescribed in such order.

Any person who acts in contravention of any order made in pursuance of this section, shall be liable to a penalty not exceeding twenty shillings.

Due notice of such order shall be published at the expense of the local rate.

The provisions in this Act contained as to the detention and sale or destruction of dogs found straying on the highway, shall apply to dogs found at large in contravention of any order made in pursuance of this section.

Penalty, how to be recovered.

4. In England and Ireland any penalty under this Act may be recovered in the manner provided by the Summary Jurisdiction Act, and in Scotland all such penalties shall be prosecuted and recovered before a court of Summary Jurisdiction, under the provisions of the Summary Jurisdiction Act, 1864.

With other animals the measures must be modified, as they rarely, when rabid, diffuse the contagion; so that veterinary sanitary regulations in their case may be only looked upon as secondary to sanitary measures—those which have to do with the flesh, milk, &c., derived from them. The veterinary regulations should have chiefly for their object the health of the animal while alive, and its destruction when diseased.

When these animals have been in contact with, or been wounded by, a rabid or suspected dog, the circumstance should be reported; when they ought to be visited by an expert as quickly as possible, and their bodies carefully examined, particularly the ears, mouth and nose, and limbs and tail, in order to discover if there are wounds, even of the most trivial description. Those which are wounded should be isolated and carefully watched. Preservative treatment may be recommended, but of course cannot be ordered. Haubner asserts that the isolation of wounded animals is unnecessary, as no danger is to be apprehended from them should they become rabid. Röll insists upon separation and surgical treatment, unless the proprietor decides to kill them. But as will be seen from our description of the symptoms, all rabid animals are aggressive, and more or less dangerous to others and to mankind, and particularly the horse and ox; even the sheep is bellicose, and has fatally inoculated people. It is better, therefore, to separate the wounded or suspected from the uncontaminated, and to place them under veterinary or police observation. Such animals as horses, oxen, and other beasts of labour, should be permitted to work in their own locality; but they ought not to be allowed to travel far beyond this on any pretext. If a mad dog has been among a herd of cattle or flock of sheep, the whole herd or flock should be placed under observation.

None of the domesticated animals, if bitten or suspected, should be sold, bartered, or removed from their own locality within a period equal to that of incubation. Röll gives four months at the least, for the sale of horses and cattle in this condition; but for other animals used as food, the minimum may be three months.

Haubner gives the period of supervision as two months for sheep, three months for pigs and horses, and six months for cattle; and perhaps these limits are preferable, as a basis for regulating the restriction, to those laid down by Röll. At any rate, it would appear to be a great mistake to fix the quarantine period at the same length for all animals; this should be regulated by the average duration of the incubatory stage in the several species.

The immediate slaughter of all the bitten animals is unjustifiable, as only about fifty per cent. of those wounded become diseased, and, when compared with dogs, the danger is then very trifling. It is, therefore, quite time to resort to slaughter when the symptoms begin to appear; unless the owner is desirous of avoiding the risk of loss, and wishes to sell the carcass for food.

As soon as the disease shows itself, notice ought to be given to the authorities, and an examination made of the animal or animals by a veterinary surgeon, when, if it be ascertained that Rabies is really present, and the owner does not object, they may be killed. All animals which are affected with confirmed Rabies should be slaughtered, and all attempts at medical treatment should be prohibited, except under exceptional circumstances.

The carcass must be buried intact, with the skin largely slashed in different directions. Haubner, however, suggests that if, with the *rigor mortis*, the virulence of the contagium is extinct, then the skins might be utilized, if carefully removed. With this suggestion we readily concur.

Should the carcass chance to be dug up and eaten by animals, there is no great danger to be apprehended, though precautions should be adopted against such an occurrence.

PRESERVATIVE TREATMENT.

The preservative treatment must be mainly directed to the removal, or destruction, of the virus in the wounds as quickly as possible after its deposition. It is therefore purely of a local kind, and consists of suction, expression, washing, compression, cupping, and cauterization. The latter is to be

preferred with animals. The hot iron, or caustics of various kinds, and of different degrees of potency, may be employed; but the object to be achieved is the thorough destruction of the poison without delay. Unless this be perfectly accomplished within a very brief period after the infliction of the wound, no guarantee can be given that the disease may not appear. Excision of the contaminated parts may also be advantageously practised in certain cases.

It must be observed that the wounds made by rabid animals whose teeth are long and sharp, are most frequently followed by fatal consequences; as the bottom of the incision is less easily reached to destroy the poison it contains.

Nothing definite can be laid down as to the period within which either of these preservative measures may be adopted with any certain prospect of success. The late Professor Renault made a series of experiments with regard to the absorption of animal poisons by raw surfaces, and from the results obtained he concluded that the minimum period was about five minutes. After twenty-four hours, according to this authority, local preservative measures are useless. Lafosse says they can only be successfully resorted to within five minutes of the contact of the saliva; though there is still hope to be derived from their application within a quarter, or even half-an-hour. Faber gives an instance of an ox whose tail, bitten by a rabid dog, was amputated within two hours after the injury, and yet it afterwards became rabid.

We would, nevertheless, be inclined to recommend the adoption of local preservative measures even some hours after the injury; for where everything depends upon their application we are quite justified in resorting to them almost at so late a period as the cicatrization of the wound.

Nothing whatever is known as to the value of any general preservative measures.*

* For a full description of the various preservative and curative measures applicable to mankind, as well as animals, *see* "Rabies and Hydrophobia," page 313, *et seq*.

It may here be insisted upon, however, that the readiest, promptest, least painful, and most efficient agent in destroying the virus introduced into a

CURATIVE MEASURES.

The cure of Rabies should not be attempted with the domesticated animals, except in veterinary hospitals, where experiments to this end may be safely conducted; for it is scarcely necessary to say that the malady is incurable. Cases of recovery are on record, but these may almost be counted on the fingers, and are to be attributed more to the quietude and darkness in which the animals may have been kept, than to the medicines administered. Constitutional resistance to the morbific action of the poison must, doubtless, be held as the chief agency in these recoveries.

USE OF THE FLESH OF RABID ANIMALS AS FOOD.

Haubner says that the slaughter of animals for food may be permitted within twenty-four hours after the bite of a rabid creature, but that the contaminated part must be cut out and destroyed; even after that period, killing an animal in order to utilize its flesh may also be allowed, provided it be consumed by the owner, and is not offered for sale.

USE OF THE MILK OF RABID ANIMALS AS FOOD.

We have no evidence to show that there is any danger in utilizing the milk before symptoms of the disease appear. Butter and cheese might certainly be made from it. People have continued in good health who have used the milk, even at the commencement of the disease; but it would be most injudicious to sanction the issue, as food, of either milk or flesh when the malady is developed.

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wound by the tooth of a dog, is the actual cautery—the iron being employed at a white heat. This should be applied unsparingly.

The plan recommended, of cutting a piece of wood to the size of the wound, inserting it therein, and then cutting around, so as to extract the wood, together with the parts in contact therewith, is a slow, clumsy, and extremely painful operation, far from certain in its results, and very often impracticable, especially with animals. Besides, it requires a skilled person, and such an one is not always obtainable until some valuable minutes, or even hours, have been lost.

DISTEMPER IN THE DOG.

SYNONYMS.—English: *Distemper, Catarrhal fever of the dog.* French: *Maladie des chiens, Toux, Morve des chiens, Rhume, Catarrhe, Bronchite.* German: *Hundekrankheit, Hundestaupe, Fallsucht, Hirnkrämpfe, Hundeseuche.* Italian: *Morva del cane, Malattia del cane.* Spanish: *Peste.*

GEOGRAPHICAL DISTRIBUTION.

This appears to be a very wide-spread disease, being well-known in Europe, Asia, Africa, and America. It is very common in Australia and New Zealand, and prevails in the torrid as well as the frigid zone; though it is generally most fatal in warm climates. Notwithstanding its present universality, its appearance in Europe is comparatively recent. Ulloa is the first to mention it in the early half of the last century (1735-46), when he observed it in South America. It was there known as the "Peste." In 1760-63, there was a great and general mortality among dogs in Spain, which is supposed, and with every probability, to have been this disease imported from South America; at which time, also, it appears to have been noticed in North America. In 1763, it appeared in England and France,* and both countries believed they had received it from each other. It was very wide-

* It must be noticed that Lafosse (*Traité de Pathologie Vétérinaire*, page 1062), asserts that it prevailed in the South of France in 1714, and was complicated with gangrenous Angina. Of this we may entertain the gravest doubts; for when the malady appeared fifty years later, it caused the greatest excitement and astonishment among the keepers of hounds and other dogs. It is certain, however, that an epizoötic disease prevailed among dogs at the period alluded to by Lafosse, as Kanold (*Breslauer Sammlung*, 1719) informs us that there was a general outbreak of sickness among the dogs in Cologne and the vicinity.

spread and fatal, and quite novel; and the nervous symptoms which sometimes accompany it caused many people in this country to think it was Rabies, and to destroy their dogs. In 1764, it appeared in Franconia and Bohemia, and in September of that year it was observed at Naples. In 1767, it was so severe in Louisiana that nearly all the dogs perished. In 1771, it visited Moscow for the first time; and in 1776, it prevailed not only among dogs, but also affected the wolves and foxes in North Africa. In 1821, it first manifested itself in Siberia, and proved most disastrous to the canine species.* Since that time the disease has been witnessed to a greater or less extent in every part of the world.

CHARACTER.

This is one of the most fatal maladies to which the canine species is liable, and destroys a great number of dogs—perhaps one-third of their number—annually. It may appear in a sporadic, enzoötic, or epizoötic manner, and a predisposition to it exists not only with the dog, but also with the cat and some other carnivores. It is more particularly a disease of youth, and is much more frequent and fatal among highly-bred pampered animals, than those which live in a less artificial manner, and whose constitution is less modified by breeding and rearing. It is characterized by inflammation of the mucous membranes of the head and air-passages, and sometimes that of the alimentary canal, with, frequently, complications of the nervous system, and, more rarely, cutaneous eruptions. Though arising spontaneously in the majority of cases, yet it is eminently contagious, among animals of the same species more particularly. In this respect it resembles some other animal diseases.

NATURE.

A great variety of opinions have been entertained as to the nature of this malady, these opinions varying generally with the medical doctrines of the age. Thus it has been

* The details of these outbreaks are given in "Animal Plagues."

looked upon as a humoral disease, the vitiated matters being got rid of by a crisis; at another time it was a malignant fever, and it has been compared to the so-called "strangles" of the horse, to Small-pox, Glanders, and irregular Bilious fever. With some authorities it was a Gastro-enteritis, Bronchitis, or a nasal Catarrh. There is no doubt that the complications which often mark the disease give it rather a protean character, and have led to these different designations being adopted as indicating its nature; but a more careful study of its symptoms and its pathological anatomy resulted in the conclusion that it is essentially a *Catarrhal fever*, of a somewhat specific nature, complicated at times with disturbance of the nervous system, and characterized usually by bronchial Catarrh, commencing with nasal discharge, and, if not checked, running on to Bronchitis and lobular Pneumonia, with disease of the eyes; or intestinal Catarrh, often complicated by an aphthous eruption, and usually terminating in Dysentery, rarely by Jaundice. We may have both these forms, with their complications, in the same animal; or they may vary at different outbreaks.

CAUSES.

Many influences appear to be capable of producing Distemper. By some it is believed to be peculiar to the canine species, which has a congenital predisposition to it, and that any occasional cause will develop it. Others, again, attribute its evolution to external causes only, and assert that there is no congenital predisposition. It is certainly a fact that, with proper care, dogs can be reared and kept during their life free from it. It is no more necessary nor natural for the canine species to be affected with "distemper," than it is for mankind to suffer from Small-pox, Measles, or Scarlatina. We have already alluded to youth as predisposing to this form of Catarrh; puppies may be attacked, and within twelve months of age the disease is most frequent and fatal. The chief causes are sudden changes of temperature, so that we usually have the disease most frequently appearing in the spring and autumn; improper bathing, draughts of cold air, cold and

wet weather, damp dark dwellings, crowding young dogs in cold, badly ventilated kennels, the immoderate use of animal food and little exercise, are all so many exciting causes. Breed, as we have already said, has a notable influence in the generation of the disease, and so has change of climate. European dogs, imported from Europe into South Africa, India, and other hot countries, perish in large numbers from it, and it is even as fatal when they are transferred from northern into temperate latitudes. Nearly all the dogs imported into England by Sir John Parry from the Arctic Regions, died from it within twelve months. It is the same with those imported from warm into cold countries. With some breeds there appears to be even an hereditary predisposition to it, and it is sometimes most difficult to keep them alive until they are a year old.

Contagion is, of course, one cause of the disease.

SYMPTOMS.

Distemper usually commences, in benignant cases, when there is only bronchial Catarrh, with slight fever, perhaps a diminished appetite, and greater desire for fluids. Or these symptoms may not be noticed, and there may only be present a discharge from the nostrils of clear mucus, which soon becomes purulent; and there is also a muco-purulent discharge from the eyes, which frequently glues the lids together after the animal has been sleeping. This condition may continue for a number of days without any other symptoms intervening, and the animal may continue to eat and be as lively as usual; or sneezing may be noticed early, and cough, at first rarely, but gradually becoming more frequent, will be heard. These symptoms will disappear in eight or ten days, and the animal be as well as usual.

In more serious cases, the cough increases in frequency, and comes on in paroxysms; it has a peculiar character, being dry and husky, evidently painful, and sounds as if it were provoked by some foreign substance in the throat. The temperature of the body is increased, and varies at different times; the animal is feverish, and has lost much of its liveli-

ness; the appetite is diminished, the creature drinks more than usual, shivers much, and seeks warmth; it becomes rather indifferent to surrounding objects, and is less obedient; the respiration and pulse are accelerated; sneezing and coughing are more frequent, especially if the animal is excited; the nose is hot and dry; the nasal discharge is yellow, purulent, and glutinous, and obstructs the nostrils, from which it is expelled by sneezing; the eyes are dull, and the discharge from them more abundant; a small ulcer may be noticed sometimes at this stage in the centre of the cornea, and the membrane lining the eyelids may be of a bright-red colour. Emaciation becomes apparent, and debility more marked; constipation may be present, with tenesmus; and if the animal is a female, there is not unfrequently a mucus or muco-purulent discharge from the vulva. The cough becomes softer after a time, and less painful; and if the ear is applied to the side of the chest, mucous *râles* may be heard, indicating that the nasal Catarrh has become bronchial. Frequently at this period the disease does not progress, but remains stationary for a variable interval; or recovery may gradually set in, with a diminution of the symptoms. Or it may fluctuate; the appetite may be capricious, and the symptoms be more serious one day, and more favourable another, the evening always bringing an exacerbation. Suitable treatment may bring about recovery at this stage, and often in a short time—a few weeks.

Should the disease continue its course, the bronchial Catarrh becomes capillary Bronchitis, either alone or complicated with lobular Pneumonia when the inflammation extends to the air-cells. Then the symptoms increase in intensity, and the debility becomes extreme. The pulse is small and quick; the cough is now but seldom heard, and the respiration is very hurried, short, and plaintive. The bronchial *râle* is audible on both sides of the chest; and when Pneumonia is present, there is a faint blowing sound heard. The eyes sink into the orbits, and are partially hidden by the membrana nictitans; the nasal discharge is thicker and more tenacious, dark-coloured and offensive, clings around the nostrils in dense crusts, and is sometimes streaked with blood; the cheeks are

inflated at each expiration, and are drawn in during inspiration; the body has a most repulsive odour, and the skin looks very unhealthy. The mouth and lips are tumefied, and they and the gums are frequently ulcerated. Recovery is extremely rare when the malady has reached this stage, and death is usually due to suffocation or extreme exhaustion. Diarrhœa, Gastritis, irritability of the stomach, or nervous disturbance, may, or may not, complicate the disease—these will be alluded to presently. Conjunctivitis is, however, nearly always present from the very commencement, and becomes aggravated as the symptoms increase in intensity. The cornea often assumes an increasing opaline tint; a gradually-increasing ulcer appears in its centre or side; this becomes deeper; minute abscesses form between the laminæ, and a protrusion —sometimes very salient—takes the place of the ulcer, and is surrounded by a red or violet-tinted areola; the suffering appears to be great, and is increased by the sealing of the lids and the pus collecting within them. Before reaching the deeper layers of the cornea, the abscess frequently opens, and there is immediate relief, recovery taking place in a short time; in other cases, however, the cornea is completely perforated, the humours of the eye escape, the iris protrudes through the opening, fungous growths spring up in it, causing the greatest torture, and the organ is irrevocably lost. This accident is not, however, very common, and, as a rule, eyes apparently seriously diseased will regain their normal condition should the animal recover.

Frequently the bronchial Catarrh is complicated with inflammation of the pharynx and gastric Catarrh. We then have difficulty in swallowing, nausea, and vomiting of a greenish-yellow tenacious mucus, with complete loss of appetite. Diarrhœa or Dysentery is another complication, and indicates the extension of the Catarrh to the intestines; in some cases, and, indeed, in some outbreaks, they are very prominent characteristics of Distemper. Diarrhœa is not in itself a serious symptom; but if it complicates the bronchial Catarrh, it rapidly increases the debility. Dysentery is present when mucus and blood are voided, and the odour is most

offensive. The animal suffers much pain, the abdomen is retracted, extreme prostration quickly sets in, the fæces are expelled at frequent intervals, and the rectum is often everted; the ulceration in the mouth generally accompanies this Dysentery, the teeth may drop out, the breath is most unpleasant, and the poor creature dies in a sad plight.

Jaundice sometimes complicates Distemper, and is marked by the usual symptoms of that disease.

The nervous phenomena rarely complicate distemper at the commencement, but usually appear after the catarrhal symptoms have been existing for some days, and especially when Bronchitis or Diarrhœa has induced considerable debility. They also frequently appear when the nasal mucous membrane and the eyes are seriously involved. These phenomena are of an epileptic character, or resemble Chorea. When the latter, there are convulsive contractions of certain muscles in different parts of the body—nose, ears, lips, limbs, &c.—these convulsions being more or less acute and persistent when they complicate the disease, but chronic when they appear as a sequel.

The acute form is most marked, and is manifested by a continuous succession of entirely involuntary clonic contractions; these involve the whole body, prevent the animal from resting, and almost hinder it from eating or drinking. In many cases the animal lies perfectly helpless, moaning or yelling continuously. The chronic form is much less marked, but it may be progressive; the will has some control over the movements. In some cases, only one limb will be at first involved slightly, and the disordered movements may increase, though still remaining confined to the limb. In other cases, it affects another limb, and perhaps the head will be involved. When the other symptoms of distemper disappear, these movements will persist; though they may remain stationary, and affect the health little, if at all: greatly subsiding during sleep, and becoming most noticeable when the animal is excited.

The epileptic seizures are always of serious import, and especially if the first is quickly succeeded by others. Immediately before the attack, the animal frequently appears to be

much better and livelier, and may even eat freely; but before the more severe attack comes on, certain premonitory convulsive movements are usually observed, such as spasms of the muscles of some parts of the body, and especially of the head, with champing of the lower jaw, and foaming at the mouth; soon the eyes become haggard, and are convulsively moved about in their orbits, the animal trembles, staggers, and falls on the ground, where it struggles about unconsciously; at other times it may dart forward, uttering plaintive cries, and continue moving about until it meets some obstacle.

These convulsions are remittent; but after several attacks the animal generally falls into a state of prostration, and they diminish in intensity; progression becomes vacillating, and partial or total paralysis sets in. When the attacks are at wide intervals, the animal frequently remains half-paralyzed; in some cases, it moves along with its head inclined to one side, turning continually in a circle, the pupil of the eye on the opposite side being dilated.

A somewhat frequent concomitant of Distemper is a cutaneous eruption of an eczematous, vesicular, pustular, or bullous character—most frequently the latter. It usually appears when the disease has been in existence some time, and hastens its course towards a fatal termination, never indicating a salutary crisis. It sometimes follows an attack of convulsions and disappears, but only to reappear with more intensity after another seizure. Animals in low condition are oftenest the object of attack. The eruption does not, as a rule, involve the whole substance of the skin, but only its superficial layers. At first there appear on the under surface of the abdomen and chest, and sometimes also on the inner surface of the thighs, little red spots, like flea-bites; in about three days, these are the seat of flat vesicles or bullæ, containing first a transparent, colourless serum, which soon becomes opaline, while the vesicles become convex, and are surrounded by a reddish areola. In two or three days these break, and thin crusts form. When these are forcibly removed, the reddened derma beneath secretes a slightly purulent fluid, which again forms a crust. In three or four days this crust is thrown off,

and leaves a smooth, reddish patch. The eruption frequently extends to the head and fore-limbs; and when so extensive, the rupture of the bullæ gives rise to a most repulsive odour, while their proximity to each other occasions somewhat large sores.

This cutaneous complication has sometimes misled inexperienced observers, and caused them to imagine the disease to be analogous to, if not identical with, Variola. For this reason, also, vaccination has been frequently recommended as a preservative measure; but of course it is perfectly useless.

COURSE AND TERMINATIONS.

The course of the disease is variable, and greatly depends upon the complications that arise, as well as the breed of the affected dog. Dogs of the less artificial kinds suffer much less, and the disease assumes a milder form in them, than those whose constitutions are softened by high breeding and unnatural treatment. Newly-imported dogs also withstand the malady badly. The disease likewise runs its course more rapidly, and is most fatal, in puppies and young dogs. Its duration may be from a week to two or three months. The benignant form may yield to careful treatment in a fortnight or three weeks; but when there is intestinal Catarrh or nervous derangement, the termination is frequently unfavourable, and sometimes very sudden.

The eyes, when they have been affected, and when the animal makes a good recovery, are none the worse, unless the cornea has been destroyed; the usual *sequelæ* are nervous twitchings, which may persist during life.

PATHOLOGICAL ANATOMY.

The alterations usually observed after death are such as might be expected from the symptoms, and these, as we have seen, are often complicated. As a rule, however, we find evidence of catarrhal inflammation of the air-passages from the nostrils to the smallest bronchiæ, which may be filled with

pus or a muco-purulent fluid, the mucous membrane being intensely congested, inflamed, or even ulcerated; the lungs, also, may present the ordinary lesions of Pneumonia. There are likewise usually observed the same catarrhal features in the alimentary canal: intense congestion or inflammation of the mucous membrane of the stomach and intestines, particularly the small intestines, with tumefaction of Peyer's and the solitary glands, from the nuclear and cellular proliferation taking place in them; sometimes these are also ulcerated. The brain and its membranes may also be congested or inflamed, and there may be, in addition, serous effusion in the cranial cavity. Similar alterations are noted in the spinal canal. Congestion of the liver may also be present in those cases complicated with Jaundice.

DIAGNOSIS.

This disease can scarcely be confounded with any other to which the dog is liable: at least by people who have had any acquaintance with the maladies of this animal. Rabies is the only dangerous affection for which it might be mistaken; but the mistake could only be made by inexperienced persons, and might possibly be due to the implication of the nervous system in Distemper. By comparing the symptoms of the two diseases, it will be seen that they differ widely, and particularly in the nervous phenomena peculiar to both. The rabid dog has no epileptic seizures or fits of unconsciousness; none of the fever, mucus or purulent discharges, or lassitude, which at an early period mark Distemper; neither has it the aggressive disposition of the "mad" dog; neither the aspect nor the voice are changed as in that malady, and there is not the same tendency to wander; in fact, there are but few symptoms in common between them.

CONTAGIUM.

The contagiousness of Distemper has often been doubted; but there must be indeed very few persons who have had any experience in canine pathology, who will not be ready to testify to its being a contagious disease, and sometimes

markedly so.* The contagium is both "fixed" and "volatile," and appears to exist more particularly in the discharges from the mucous membranes of the nostrils and eyes, at a very early, as well as a late, stage of the disease; and possibly also in those from the bowels, when these are seriously affected. With regard to the contagiousness of the exudation in the cutaneous eruption, Leblanc asserts that it is highly virulent; but Röll has not been successful in the experiments he devised with the object of proving this. The expired air and cutaneous exhalations are vehicles of the contagium. The malady can also be produced by inoculation with the nasal discharge.

VITALITY OF THE VIRUS.

We are not in possession of any precise information with regard to the vitality of the Distemper virus. It is probable that it is somewhat persistent in favourable circumstances.

INFECTION.

The infection is communicable between animals of the same species, and perhaps also to others. The matter from the cutaneous bullæ when conveyed to the human skin, will sometimes produce a pruriginous eruption.

MODE OF INFECTION.

Infection may be produced by cohabitation, and consuming food or water containing the muco-purulent discharge. It may also be produced mediately and by inoculation.

* An instance recently occurred in my own experience. A Pomeranian dog, six months old, in excellent health, and well attended to in every way, and which I was particularly anxious to preserve from the disease, accompanied me one morning to barracks, where in a stable were a number of blood-hound puppies suffering from a very severe form of Distemper, which eventually killed them all. My dog crept into the stable unobserved while I was examining the patients, and lapped some of their beef-tea before it was noticed. In about a week, this animal was affected with the disease, and was with great difficulty saved; and a very small toy terrier, which slept in the same basket, but which must have been about three years old, was in a few days also sick, though it did not suffer so much as the puppy. This happened in summer, when the weather was warm.

MODE OF ACCESS.

The virus may obtain access by the stomach, air-passages, or skin.

INCUBATION.

The period of incubation would appear to vary from one to three weeks.

EXTENSION.

The disease, beyond the atmospherical and other causes already enumerated, is extended by contact, mediately or immediately, of the sick with the healthy. One or two Distempered dogs in a locality, if at large, will soon infect the young dogs coming into contact with them, and the disease may in this way, under favourable circumstances, soon become widespread. Animals recovering from the disease, and when nearly well, may yet contaminate others.

MORTALITY AND LOSS.

This, as has already been said, is a very fatal disease, particularly among the more valuable high-bred dogs, frequently killing one-half or three-fourths of their number. Among sporting dogs it is sometimes a serious scourge.

IMMUNITY.

One attack of the disease does not give exemption from a second or third, though these may be milder. Animals more than a year old are much less predisposed, and recover much more easily, than those which are younger. Some dogs escape the disease altogether, and many more would never be affected if properly cared for. After dogs are twelve months old, they are much less likely to become affected. Some, as in other contagious diseases, will not take the malady when exposed to infection, and will even resist inoculation.

SANITARY MEASURES.

The sanitary measures are preventive, protective, and suppressive.

PREVENTIVE MEASURES.

The preventive measures consist essentially in preserving young dogs from the operation of those influences which we have cited as causing the disease. Cold and wet are to be particularly avoided, and great attention should be paid to the diet. Puppies should not be removed too soon from their mother, and animal food should be sparingly given for some time.

With well-bred dogs, these precautions are particularly necessary, and especially those with regard to cold and wet. The kennels should be dry, and well lighted and ventilated. Only dogs which have the disease in a mild form should be bred from; as there can be no doubt that certain breeds, as well as certain individuals, are more predisposed than others to this disease.

Puppies born in the early spring stand a better chance of passing safely through, or even altogether escaping, the malady, than those of autumn; as they are better able to resist the wet and cold of winter.

Care should be taken to keep them away from dogs suffering or recovering from the disease, or places tainted with the contagium. Precautions should be maintained until the animal is at least twelve months old.

PROTECTIVE MEASURES.

The inoculation of young dogs with the nasal discharge of those which are sick has frequently been recommended and practised, in order to get them over the disease at a favourable period. But it is not at all necessary that dogs should have the Distemper—indeed, they are much better without it; as, even if they do survive, there may be much inconvenience and expense incurred in treating and nursing them, and trouble-

some *sequelæ* may remain; and, as we have said, one attack does not afford security against another. The result of the attempts which have hitherto been made in this direction does not tend to encourage its further adoption.

Vaccination has also been recommended as a protective measure by those people who imagined it bore some analogy to Variola; it is needless to state that it has been found perfectly useless, and affords not the least protection.

SUPPRESSIVE MEASURES.

The suppressive measures are very simple. Isolation of the sick from the healthy, and careful disinfection and cleansing, are all that is necessary. Dogs with Distemper should not be allowed to stray; and when they have recovered, before being allowed to mix with other dogs, they ought to be well washed with carbolic acid soap or lather, and carefully dried. All straw, clothing, and other articles soiled by the sick, should be either destroyed or thoroughly disinfected; and the dwellings they have inhabited ought to be scraped, washed with hot alkaline water, and lime-washed, or dressed with a solution of carbolic acid.

CURATIVE MEASURES.

The curative measures depend greatly upon the stage of the disease, and the complications which arise. At the very commencement, the course of the malady may often be cut short by giving an emetic, keeping the animal very warm, and limiting the diet to only a small quantity of milk or beef-tea. The emetic may be tartarized antimony, two to four grains, according to the size of the animal, and given in an ounce of distilled water. The diet should be light, and the dog kept in a warm, equable temperature. When the catarrhal symptoms of the head and air-passages are rather severe, the hydrochlorate of ammonia, nitrous æther, port wine, or chlorodyne, should be administered in quantity proportioned to the size of the animal. Should the Bronchitis become marked, and Pneumonia be apprehended, the throat and sides ought to be

stimulated or blistered. I have found great benefit from hot poultices round the chest.

Debility sets in very early; care must therefore be taken to sustain the strength by stimulants, and nourishing food in the form of beef-tea and milk.

When there is gastric complication, without Diarrhœa, tartarized antimony may be given; but when the latter appears, and Dysentery is apprehended, white hellebore and ipecacuanha should be prescribed; or opium, rhubarb, Dover's powder, quinine, prepared chalk, or other suitable remedies.

Langenpacher and Busse, according to Röll, recommend, so long as no nervous complication is present, the application to the sacral region and limbs of a decoction of hellebore—six to sixteen drachms, in a bottle and a-half of beer. This remedy acts as a counter-irritant and emetic, as the animals, in licking themselves afterwards, swallow a portion.

When nervous phenomena appear, setons or blisters in the region of the head and spine are to be recommended; or ice may be applied to the head; and if there is constipation, a purgative must be given. Chloral might prove very useful. Tincture of nux vomica, or the subcutaneous injection of strychnine, may be resorted to at a certain stage. In the convalescent stage, tonics and good food regularly given are necessary.

I have been tolerably successful in cases of Distemper, by keeping the animals clean and warm, giving sherry and quinine from the commencement of the disease, and plenty of beef-tea. Sometimes the throat has to be slightly blistered, or the sides of the chest may require mild vesication. Should Diarrhœa appear, it is to be treated with rice-water injections, and tincture of opium or chlorodyne.

The eyes, when involved, should be kept clean by gentle washing with tepid water and milk, and dressing with sulphate of zinc collyrium. The nostrils should also be kept free from discharge as much as possible.

Convulsions and chorea, when chronic, must be treated according to their indications. Tonic medicines, good food, exercise, and a change of air often succeed. They sometimes

disappear when the animal has attained adult age. With bitches, chorea has been known to disappear after parturition.

Various remedies have been prescribed for the treatment of Distemper, and amongst them the administration of coffee, carbolic acid, tincture of aconite, &c. But it will be found that warmth, cleanliness, and good nursing, are the chief points to be attended to.

CONTAGIOUS DISEASES OF THE GENERATIVE ORGANS.

VENEREAL DISEASE OF SOLIPEDS.*

SYNONYMS.—Technical: *Lues venerea equis, Frambæsia morbus pustulosus*, &c. French: *Maladie du coït, Maladie vénériennedes Solipedes, Maladie paralytique du Cheval, Paralysie épizootique, Paraplégie épizootique, Morve de l'appareil de la génération, Cachexie lymphatico-nerveuse, Phthisie nerveuse, Epizootie chancreuse.* German: *Eczemausschlag, Chankerkrankheit, Aphthen-und Beschälausschlag, Phlyctanenausschlag, Gutartige Beschälkrankheit, Pseudo-Syphilis, Venerische Krankheit der Pferde, Lahmungskrankheit, Bösartige Beschäl-oder Chankerkrankheit, Franzæsische Krankheit*, &c. Arabic: *El dourine, Dourinn, Dœauridh.* (I am unable to ascertain whether such a malady exists in our Indian possessions. The Gonorrhœa of cattle in Bengal is designated in the vernacular *Dhat er beram.*)

GEOGRAPHICAL DISTRIBUTION.

This is a malady which has only come into notice within a comparatively recent date, and we cannot do better, in attempting to define its geographical limits, than give a brief sketch of its history. The first notice of the disease is that given by the German veterinarian, Ammon, in 1796, and again in 1799; he observed it in the district of Trakehnen,

* I have given this interesting, serious, and obscure malady, a place here, as not only is it of scientific importance to the comparative pathologist, but though at present unknown in Britain, it may soon make its appearance; seeing the tendency there is for such diseases to become universal, and appreciating the fact that continental countries, having possessed themselves of our best horses, are now breeding them in such numbers, and of such a superior quality, that probably in a short time we shall be importing these animals from them, as we now import cattle, sheep, and pigs.

This is the first complete notice of the disease in the English language.

North Prussia, affecting mares and stallions. It persisted in this locality until 1801, when Count Lindenau, master of the horse to the King of Prussia, caused it to be carefully studied by Reckleben; and two years afterwards (1803), Ammon and Dickhauser gave an excellent description in Tenneker's Gazette (vol. iii.). From 1801, the malady disappeared from Prussia, but extended northwards, causing much loss in Lithuania; and returning again to Trakehnen in 1807, where it once more came under the cognizance of Ammon.

Such is the early history of the disease; but it was believed to have been seen in Southern Russia before this period, and Renner mentions that it prevailed among the horses in the imperial stud at Skopin, and in the governments of Kazan, Pottchinkoff, and Nischnei-Novgorod, where it was studied by Kersting, and to which it had been brought by English stallions (?). It may be mentioned, however, that doubts have been entertained as to the reliability of Renner's statement.

In 1815, Woltersdorf, veterinary surgeon of the Bomberg district, Austria, observed it in the neighbourhood of Wanhau; and Havemann, director of the Veterinary School of Hanover, remarked it in 1816 in a stallion in the vicinity of Blockley, Hanover. This animal infected several mares, which, in their turn, propagated the malady; so that it prevailed in that country until 1820. In 1817-18, it again showed itself in Lithuania, and re-appeared in 1819 towards the Austrian frontier, at Oberschliessen, district of Liebschütz. It showed itself, in 1821, near Steiermarck and Pharau, where it attacked a large number of animals; it also broke out in Silesia, and at the stud of Lembus. In Styria, it pursued its course as a veritable epizoöty.

In 1826, it re-appeared in Silesia in a small number of animals, and in a benignant form. From 1827 to 1830 it caused a great mortality in Bohemia; and in the spring of 1830, it appeared for the first time in Switzerland, in the Canton of Berne.

Latour and Dayot, from 1830 to 1832, observed a disease of an eruptive nature affecting the genital organs of horses in France (*Recueil de Méd. Vét.* for 1835); but, according to

competent authorities, it does not appear that this was the malady now under consideration.

In 1833, it again broke out at Oberschliessen, and manifested itself in the provinces of Liebschütz and Oeltz, in Upper Silesia; in 1836, it was particularly severe in the latter province, in the districts of Striegau, Oeltz, Beissz, Grotthau, Liegnitz, Fauer, and Friestadt.

Pomerania was visited with the benignant form in 1839; and in 1840 it re-appeared in Silesia on an extensive scale, and in a malignant form, in the districts of Bartenstein and Schippenbeif; and again in that country in 1841, at which period it was seen at Gumbinnen, in Lithuania. In Würtemberg some mild cases were observed.

The disease had now assumed such serious proportions, and was causing so much alarm in the stud-farms and among private horse-breeders, that severe legislative enactments were adopted and enforced; at the same time veterinary surgeons were beginning to devote their energies towards investigating its nature, and the most efficient prophylactic measures to be devised against it. These checked its progress in Germany, and the cases that subsequently occurred were less serious.

In 1847, it was reported in Algeria by the French military veterinary surgeon, Signol, who saw it in the province of Constantine, and who described it as an "Epizoötic paraplegia that had appeared among the horses of the Rigas tribe." Not aware of the existence of the malady on the European continent, he designated it by one of its chief symptoms; he also mentioned that the Arabs had long been acquainted with it, that it appeared in a serious form every fifteen or twenty years, and that one of these crises, the one to which he was a witness in 1847, destroyed six hundred horses.

General Daumas, author of the "Chevaux du Sahara," alludes to the frequency and ravages of the disease among the horse of the tribes in the province of Constantine; and Bonjol, another army veterinary surgeon, reports it as causing great havoc in the Bhiras tribe. In 1852, it carried off a large number of mares in the circle of Bou-Arreridj; and in 1853, it prevailed in the circle of Setif.

It was not until the spring of 1851 that it revealed itself in France, among the brood mares in the plain of Tarbes, where it for the first time attracted the attention of French veterinary surgeons; being chiefly studied by Roturier and Louchard, military veterinary surgeons, and by an official commission. In 1851, the malady was located in thirty-one communes around Tarbes, containing 1,874 mares. In December of that year, Louchard recognized it in 127 mares which had been put to government stallions, and to stallions belonging to private individuals. The first had covered 750 mares, and 100 became diseased; the other twenty-seven were infected by the private stallions. Out of the total number fifty-two died. It had nearly ceased in the following year.

In 1852, the disease appeared in the valley of Lourdes, and near Argelès; and Professor Yvart and Lafosse, of the veterinary school of Toulouse, undertook, by a series of experiments, to demonstrate its contagiousness.

It re-appeared in some mares and stallions at Tarbes in 1856, 1857, and 1858, and at this period it was studied by Reynal, director of the Alfort Veterinary School. It also manifested itself again in 1861.

With regard to the origin of this disease in France, Trelut, veterinary surgeon to the stallion depôt at Tarbes, in two able memoirs on the subject, traces its advent to the importation of a stallion from Syria in 1851, and again by two other stallions from the same country in 1861. He asserts that it was perhaps perpetuated in the South of France, because it there found itself in a climate resembling that of Syria, where it nearly always prevails; and also because no steps were taken to thoroughly eradicate it.

This is, so far as I can trace it, the geographical limit of this curious disease. It has not been witnessed as yet in England, Belgium, Italy, Spain, or Denmark, nor in countries beyond Europe, Asia, or Africa, so far as I am aware; but there can be no doubt that if diseased stallions or mares are imported to those regions now exempted from its effects, it will appear there, as it has done in Russia (where it is frequent and violent, particularly in the southern governments), Germany, Hungary, Bohemia, and France.

CHARACTER.

This disease is peculiar to solipeds—asinine as well as equine; it is contagious, and is transmitted in the act of copulation. It chiefly affects the generative organs; though it is not confined to these, but produces serious general disorders of a peculiar character, which most frequently terminate in death. It, like several other contagious diseases, sometimes assumes an epizoötic form. It is more of a chronic than an acute malady, its course being slow and remittent; and affecting more or less every organ in the body, it produces a state of marasmus, hideous in the extreme, before death supervenes.

NATURE.

Very little is known of the nature of this affection. Some authorities have imagined it to be allied to human Syphilis, basing their supposition on the course of the local symptoms, some of the pathological alterations, and the serious character of these; this idea has been rejected by others, seeing that human Syphilis is not transmissible to the horse by inoculation, and that mercury acts almost as a specific in that disease, while it is impotent in arresting the ravages of this equine disorder.*

Some of the German writers, keeping in view the symptoms of nervous derangement manifested towards the later stages of the malady, have looked upon it as a neurotic disease; and because of its being almost constantly accompanied by changes in the lymphatic system, have designated it a "lymphatico-nervous cachexia." Others have regarded it as

* For some years experiments have been conducted by various authorities, with the view of producing Syphilis in animals by inoculation, but generally with negative results. Auzias Turenne asserted that he had so induced the disease in a cat, and a few others have observed some unimportant symptoms following inoculation; but nothing like this malady has been noted.

The most recent experiments of Horand and Peuch are apparently conclusive that human Syphilis cannot be transmitted to the domesticated animals.

a scrofulous or a scorbutic disease, or a nervous phthisis; but these, again, have been shown to be erroneous views. It has likewise been considered of an inflammatory nature, but it is devoid of the general characteristics of inflammation.

Finally, it has been grouped, by certain French authorities, with typhoid affections of an epizoötic kind; and sometimes classed among the diseases of the generative organs.

Certain observers consider the paralytic affection that generally manifests itself during the disease, as an idiopathic alteration of the spinal cord, produced by too frequent coition, and thus establish a difference between the affection and the chancrous malady; and Röll confesses that at one time he believed in this difference. But from the facts he has recently gathered, as well as from the numerous observations made by Maresch, in Bohemia, where the disease has prevailed for many years, he is now convinced that the group of symptoms described as the "paralytic disease," belongs essentially to the chancrous malady in a more developed form. He is also certain that the malady may run its course without any symptoms of paralysis showing themselves; but that these symptoms cannot be present without being accompanied, or at least preceded, by the characteristic lesions of the generative apparatus. The weakness and paralysis that sometimes appear during the progress of the disease, do not, in his opinion, depend primarily upon an alteration in the spinal cord, but rather on an inflammatory irritation of the neurilemma investing the nerves supplying the parts whose functions are deranged: the inflammatory lesions in the crural and sciatic nerves being sometimes very remarkable. It is quite possible that this inflammation may be transmitted to the spinal cord.

With regard to the development of the disease, and the cause or causes operating in producing its different manifestations, as well as the connection between these manifestations, there is nothing satisfactory or reliable.

Without entering, then, into any further discussion of the views entertained with regard to the nature of the disease, we may at once aver that at present no definite conclusion

can be arrived at; and we must be content with the statement that it is an eminently virulent malady, of a specific nature, generally marked at first by local signs, and subsequently by constitutional derangement of a grave character.

CAUSES.

The primary cause or causes of this disease are as obscure as its intimate nature; though there is no lack of hypothetical reasoning on the subject. Rodloff gives, as a general cause, an atmospherical epizoötic constitution, which gradually modifies the animal-economy until the evolution of the disease is possible; he also invokes cosmo-telluric influences, and asks if the frequency of the storms in the mountains of Bohemia and Silesia has not contributed to render the malady more common than in previous years. This distinguished veterinarian also believed that hereditary tendency, a catarrhal condition, cutaneous eruptions betraying a lymphatic dyscrasy, are all so many predisposing causes. The determining causes in the two sexes he imagined to be too frequent copulation, causing local superexcitation of the generative organs; and also the non-satisfaction of the venereal orgasm, from allowing the two sexes to approach each other without meeting. It is unnecessary to remark that all these causes are insufficient to account for the production of the disease, as they are in operation in countries where it is yet unknown.

The Tarbes commission also fell back on atmospheric influence as a predisposing cause, in addition to those relating to hygiène and diet: the determining cause being coition.

Strauss attributed its evolution to the crossing of breeds, and the artificial manner in which horses and mares were reared; and Signol invokes the same causes.

Röll, remarking that the malady is only witnessed among breeding animals, and is propagated by coition, states that it is not yet positively ascertained whether it is primarily developed in the mare or horse, or in both; but that the latter is the most likely, and it is possible that an abuse of the genital functions in the male, and the existence of a vaginal Catarrh in the female, are its occasional causes. It is true that, in ad-

mitting this mode of production, we cannot explain the specific action of the secretion observed in this disease, and which, according to certain authors, ought to be considered as analogous to that produced in human Syphilis.

Hertwig and Renner attributed its production to fornication or bestiality; and Daumas mentions that the Arabs, believing it to be contagious and incurable, think that the male ass infects the mare, the former acquiring it from the female ass, which is diseased through an abominable offence committed upon it by Arabs suffering from Syphilis, and who fancy that this odious practice will cure them.

Lafosse, commenting on the influence of cross-breeding, mixture of races, migrations, change of climate, and the mingling of eastern blood, concludes that all these, and particularly the latter, have changed the constitution of the horse, so far as its diseases are concerned, and have prepared it for the evolution of new and unknown maladies. But these influences, again, have been at work in this and other countries which are not visited by the disease now under consideration. It must, therefore, be confessed that an examination of all the inductive and hypothetical reasons given for its manifestation, leave us in the dark with regard to its origin.

It certainly appears to be much influenced by the season, according to observers in France, Germany, and Africa: being most prevalent and serious in the spring.

It also most frequently attacks high-bred stallions in preference to those of common breeds; and Reynal mentions that the latter have covered diseased mares without becoming infected, while they have communicated it to mares they were put to afterwards on the same day.

SYMPTOMS.

Two forms of the disease are recognized—a benignant (the *Eczemausschlag* or *Gutartige Beschälkrankheit* of the Germans) and a malignant (*Bösartige Beschälkrankheit* or *Lähmungskrankheit*) form. We will notice both these forms as they appear in the mare and stallion, following the description of the disease as given by the French authorities, especially

Reynal, and indicating the differences between this description and that given by the German veterinarians.

Benignant Form—MARE.

The general symptoms at the commencement of the disease are often so trivial that they do not attract attention, usually appearing in from twenty-four hours to eight or ten days after being put to the stallion. The animal is restless, and stamps with the hind feet, whisks the tail from side to side, frequently stretches to micturate, but only voids a small quantity of urine at each attempt. It rubs the vulva with the root of the tail, and, if able to get near a wall, appears delighted to affriction this region against it; the clitoris is frequently erected, and there are all the signs of œstrum, so that the commencement of the disease is often mistaken for this condition. Owing to its persistence, the mare is frequently sent to the stallion again. This unusual excitement of the genital organs should arouse suspicion, if the disease is known in the country. There may also be loss of appetite and constipation; though they are so slight as seldom to be noticed in the majority of cases.

The local symptoms consist, at first, in a heightened redness of the vaginal mucous membrane, and tumefaction of the labia of the vulva, with the escape of a muco-purulent discharge therefrom. This discharge is at the beginning slight and serous, and merely renders the parts sticky; but it soon increases, becomes thick, viscid, and white, yellow, or reddish-yellow in tint, concreting around the vaginal orifice, and soiling the perineum and tail.

The mucous membrane of the vagina becomes of a deep or reddish-violet hue, and it and the vulva become the seat of œdematous infiltration—doughy or hard—which not only extends to the labia, but descends more or less in the perineal region. At this time there appear on the mucous membrane of the vagina, vulva, and clitoris, small miliary pustules, which soon become little superficial ulcers, no more than one-fifth of an inch in diameter. These ulcers are not long in cicatrizing; but they are replaced by others which, like the first crop, are most numerous in the fossa navicularis, on the clitoris, and

near the margin of the vulva. These symptoms are intermittent: disappearing for some days, and again manifesting themselves; in the majority of cases becoming milder, until they finally disappear.

Sometimes, as Reynal remarks, this benignant local form is accompanied by general symptoms somewhat resembling those of the malignant form. For it is to be remarked that between the two there are no sharply-defined limits, but rather an insensible transition, according to the seriousness of the general or local symptoms. The former consist in a diminution of appetite, emaciation, debility, sudden twitchings-up of the posterior extremities, ecthymatous eruptions, and tumefaction in the submaxillary space.

Animals recover from this form of the disease readily enough, the symptoms gradually diminishing and disappearing, without leaving any trace of the affection. Sometimes, however, three or four months afterwards, there may still be seen a thickening of the vaginal mucous membrane.

The ordinary duration of the malady is at the least fourteen days, and at the most two months. But it may become aggravated, particularly if the mares have again sexual contact with the diseased stallions: which occurs when the disease has been mistaken or unrecognized. It then becomes malignant.

Such are the symptoms of the mild type of the malady in France; in Germany they appear to be somewhat different—the variation, perhaps, depending upon the different source of the primary infection—that in France being derived from Syria, while the disease appears to have been introduced into Germany from Southern Russia. The German veterinarians have described the malady as commencing with a vaginal Catarrh, as in France, with tumefaction of the vulva and infiltration of the mucous membrane in this region; though in some cases the swelling may disappear after a time. The labia become flaccid, wrinkled, and at times spotted, in consequence of the loss of pigment; or the colour is an uniform reddish-yellow. The lining membrane of the lips of the vulva is plicated, or exhibits infiltrated œdematous or gelatinous rings; and, at a later period, corded or conical excrescences at the

vulvular orifice and around the clitoris, or at times variable-sized vesicles containing a yellow fluid. These vesicles rupture, leaving a slight loss of substance in the membrane, covered with a yellow exudat which, in drying, gives rise to the formation of crusts. The erosions gradually cicatrize.

According to Maresch, who studied the disease in Bohemia, the eruption of vesicles has been absent in the last invasion of the disease in that country; but, as in France, there have been frequently observed white spots, the size of a grain of millet, disposed in groups, and apparently due to the tumefaction of the follicles through an exaggerated proliferation of the cells.

In other cases, as Röll has had occasion to observe in several mares belonging to an important stud, there are on the vulvular mucous membrane deep diphtheritic ulcers, with highly injected and infiltrated borders. An analogous loss of texture is sometimes met with on the mucous membrane of the uterus. The liquefaction and elimination of the exudat takes place much more slowly in the latter case, and after recovery there remain thick, corded, and stellate cicatrices. The vaginal discharge is usually very abundant, and of a disagreeable character; at times it is sanious, and occasions slight excoriations to the parts it comes in contact with.

The general condition of the animals is not changed. With robust-constitutioned mares, the malady remains purely local, and terminates in recovery after a variable time: usually over several weeks, or even months. They are liable to relapses.

Benignant Form—STALLION.

In France, the symptoms of the disease in the stallion do not appear to be so marked as in the mare, and not unfrequently several weeks pass away without any indication of its existence being manifested. At other times it appears in a few days after *coitus*, as an indolent, œdematous, but intermittent, inflammation of the prepuce; and in some cases there is œdema, with collapsus of the penis. The disease may become aggravated and malignant, as in the mare.

Malignant Form—MARE.

At the commencement of this form we have the same symptoms as in the benignant form: uterine excitement, slight swelling of the lips of the vulva, redness of the mucous membrane, discharge, &c. After three or four weeks the symptoms become more accused; the tumefaction of the vulva increases and diminishes by turns; sometimes it remains limited to the labia and the inferior commissure; at other times it descends in the perineal region to the mammæ; and at other times, again, it is unilateral, and gives a deformed appearance to the vulva.

The mucous membrane is red and swollen, with more or less deep-coloured patches and conspicuous wrinkles, and the miliary pustules and cicatrices already described; while the temperature of the vagina is increased. On the external surface of the labia, the perineum, and inner faces of the thighs, there are often ecthymatous lenticular pustules, which are succeeded by small circular sores that readily heal.

There is vaginal Catarrh, the matter being viscid, glutinous, dirty-white in appearance, and frequently possessing a strong odour. This discharge is increased after *coitus*, during fits of coughing, exercise, and the emission of urine, which it either precedes, accompanies, or follows. It adheres to the hair, soils the tail, perineum, inner surface of the thighs and the hocks, and, in drying, forms yellow or brownish crusts. At a later period it is endowed with irritating properties, due to the presence of a free acid, and causes depilation of the coat at those parts it comes in contact with; then it changes its character, becoming thick, purulent, of a yellow or reddish-colour, and gives off a strong and disagreeable smell.

The mucous membrane of the vagina and the vulva is also modified, and assumes a marbled appearance; the labia open, and the hypertrophied clitoris appears in the inferior commissure, all having a lardaceous consistency; while the vaginal orifice, deformed and gaping, resembles the anus of an old horse.

Mares which have conceived usually abort towards the third or fourth month of gestation ; though this accident does not stay the progress of the malady. Should the full term of pregnancy be reached, the foal produced is dwarfed, badly formed, and either dead at birth or dies soon afterwards. The exceptions to this rule are very rare.

The emission of urine gives rise to pruritis, and occasions uterine excitement at the commencement of the malady ; as the latter progresses the urine becomes thicker and viscid, and charged with salts which are deposited on the labia of the vulva, in the navicular fossa, and on the clitoris.

These local symptoms are not present in every case with the same intensity, the individual differences being often very great ; it sometimes even happens that they are scarcely noticeable. The general symptoms appear in the following sequence : emaciation, lameness, nervous derangement, Paralysis, marasmus, Glanders and Farcy, and death.

If recovery takes place, it is only in those cases in which the disease is little developed ; then the morbid phenomena diminish, the wasting stops, the vigour returns, and the other symptoms quite, or nearly, disappear : though there often remains paralysis of the labia of the vulva, with hypertrophy of the vaginal mucous membrane. This recovery, which is rare, may take place after seven, eight, and ten months, or even longer. Lafosse, in his experiments, saw a case of recovery after nineteen months' continuance.

The duration of this malignant form is extremely variable. Death has occurred in five months, a year, and even two years ; but frequently before this interval has elapsed the animals are killed, or intercurrent maladies hasten the disease to a fatal termination.

In Germany, the inflammation of the mammæ has been observed, and this ordinarily terminates in suppuration,—or circumscribed inflammations of the skin and connective tissue are discovered in the vicinity of the anus. In weak constitutioned animals there is also œdema of the abdomen, perineum, and extremities. A flocculent discharge from the nostrils may also ensue, with tumefaction of the submaxillary lymphatic

glands; though Röll asserts that Glanders and Farcy rarely complicate the disease.

In that country it has also been remarked, that if the malady continues for a considerable period, there appear in different parts of the body—especially on the neck, shoulders, chest and abdomen, and croup, more rarely on the limbs—circular, flattened, but well-defined swellings, one or two inches in diameter, and confined to the skin. These swellings persist for one or two weeks, and gradually disappear, while others are developed elsewhere; their margin is the last to subside.

It has likewise been noted, in Germany, that in those mares which are affected in the highest degree, there finally appear symptoms of weakness and paralysis. The former first manifests itself in feebleness of the hind quarters: the animal frequently resting its posterior limbs alternately, or, if walking, it drags them forward in a listless manner. In other cases the hocks and pasterns are suddenly flexed, the legs being thrown forwards as if by a spasmodic effort,—and sometimes the animal falls and cannot arise again until after some time. Not unfrequently the local alterations improve when symptoms of paralysis appear, and this amendment may be temporary or permanent.

It may be, as Maresch has remarked, that an examination of the animal at this period will discover only the paralytic symptoms, and the re-appearance of chancres afterwards will lead to the supposition that they are a secondary, not a primary, symptom. The paralytic phenomena sometimes disappear, while the affection of the genital organs persists or re-appears; more frequently, however, the feebleness gradually increases, and terminates in complete paralysis of the posterior extremities. Emaciation then rapidly progresses, the flanks become hollow and the belly drawn up,—the ribs are prominent, the shoulders wasted, and the hips angular and sunken. Finally, the animals are unable to rise; and sloughing sores, from the prolonged lying, are produced on the salient parts of the body. In some cases there is paralysis of one or other ear or a lip, and the creatures at length succumb in a state of

marasmus, or in consequence of hypostatic or metastatic Pneumonia.

Malignant Form—STALLION.

At the commencement of the malady, the symptoms are sometimes so trifling that they are likely to be unperceived, especially if the disease does not exist in the country. Its primary manifestations are uncertain; sometimes it appears early, at other times there is a long lapse before its presence is ascertained; and, again, it may remain latent, and only develop itself after the excitement of coition.

One of the first symptoms is swelling of the prepuce, which increases in volume; the infiltration extends behind to the scrotum, and is limited in front to the extremity of the sheath, where it forms a semicircular ring: though it may spread beneath the abdomen to the sternum, the skin being infiltrated and thickened, and on the sheath smooth and shining, while the swelling itself is doughy and indolent. This is frequently the only symptom visible for a long time; and Reynal remarks that stallions have had it for eight, ten, and twelve months before other symptoms were exhibited. In a case at the Alfort School, two small erosions, about one-third of an inch in diameter, were observed on the outer surface of the prepuce, but they healed rapidly.

After a certain time, these local symptoms are accompanied by others of a general kind. There is dulness, pawing, and loss of condition, though the appetite is unimpaired. In some cases the testicles remain healthy; in others they are larger, pendent, and betray a more or less morbid sensibility. In order to examine the penis, a mare should be presented to the stallion, which, at the commencement of the affection, has lost none of its ardour; though, at a later period, this decreases until copulation can scarcely be effected.

The penis, when completely erected, in the majority of cases offers nothing abnormal; sometimes the mucous membrane is redder, especially at the tranverse ridges, and it may even bleed at certain points; but this is not a distinctive feature of the disease, being frequent with stallions which are

much used. At other times the penis has a faint bluish or violet tint, which forms the basis for a kind of large ecchymotic spots, generally elliptical in shape, varying in diameter from one-third of an inch to one inch, and deeper in colour than the other portions of the mucous membrane; these spots are neither above nor below the general level. Other more conspicuous and more numerous spots are observed nearer the glans; these have a yellowish-white hue, which contrasts strikingly with the colour of the mucous membrane, and their diameter varies from one-thirtieth to one-sixth of an inch; their border is well defined, though not raised, and altogether they look like the cicatrices of minute superficial ulcers. It is probable that they are the remains of vesicles which have been destroyed.

The organ is often infiltrated, and its head is so increased in size that copulation is difficult, or even impossible. Some observers have noticed atrophy of the penis and testicles.

When the stallion has been put to the mare, it is remarked that after the genital excitement has passed off the penis is not retracted within the prepuce as usual, but remains in a state of semi-erection for hours; and even after this has passed off it hangs beyond the prepuce, soft and wrinkled, to about the extent of an inch.

Usually micturition is frequent, and it sometimes requires a long preparation, the efforts appearing to be painful to the horse. The animal stretches, separates the posterior limbs, while the penis is protruded and pendent, and these manœuvres may be repeated several times before any urine is passed; this takes place by a little uninterrupted jet the thickness of a quill, and the fluid is thick, yellow, and viscid like synovia. It has been found to contain albumen.

After micturition, the horse paws and appears uneasy, as if the urine irritated the urethra.

The disease may remain for a long period limited to the swelling of the sheath. After a time it is perceived that the animal is not so vigorous as usual,—it rests more frequently, and does not evince much ardour when mares are exhibited. As yet the appetite is good, but there is a loss of condition, and

also gradual emaciation, which is scarcely noticeable until after several weeks or months; the coat looks dry and the skin tight and inelastic, and the slightest pressure on the loins causes the horse to evince symptoms of tenderness. Soon afterwards difficulty is observed in walking; there is swaying of the croup, and apparent weakness of the posterior extremities. Standing is fatiguing, and the hind limbs are alternately rested twenty or thirty times a minute. Still later, when trotted the animal goes as if its loins were affected; the croup swings from side to side, and it, as well as the hocks, is much flexed when the pace is suddenly checked.

There is marked lameness of the hind, or one of the forelimbs; most frequently it is confined to the right hind leg. The hip-joints are painful, and when the hind feet come to the ground they are jerked up again, as if the horse was affected with stringhalt. At times the weakness is so great that the animal falls to the ground like an inert mass.

These symptoms are intermittent. A horse that goes lame to-day may not be lame two or three weeks hence; then the lameness will again appear, and diminish or increase until the feebleness terminates in death.

There is tumefaction of the submaxillary lymphatic glands and those of the inguinal region, and a discharge from one or both nostrils, while the eyes are lachrymose.

At an advanced stage of the disease, the appetite is variable and capricious; the food is eaten slowly, and the hay is often held listlessly between the lips, as if the animal forgot it was eating, or the jaws were fatigued. The mucous membrane of the mouth is pale, or of a yellowish-leaden hue; and above the incisors of the upper jaw ulceration has been witnessed, though this was quickly followed by cicatrization. The other symptoms denote debility and exhaustion.

In some cases a peculiar symptom is remarked. This consists in excessive pruritis, confined to the posterior extremities, and which persists until death ensues. The stallion gnaws itself about the pasterns and feet so continuously and severely, as to produce serious wounds. At other times it seizes its

manger, or anything else accessible, with such savageness that the teeth are sometimes broken in their sockets.

In other cases, very peculiar nervous symptoms—epileptiform in their character—appear. At the approach of a mare, the stallion will be seized with a kind of spasmodic trembling; the muscles of the neck stand out in strong relief; the head is extended, and shakes convulsively; the lower jaw moves from side to side; the eyelids, widely dilated, expose a large surface of the eyes, the sclerotica of which appears of a bright-yellow colour, while the organs themselves roll about in their orbits in a strange manner; and the respiration is snorting and excited, the nostrils being widely expanded. These singular phenomena persist until the animal has gained sufficient energy to attempt copulation.

At a later period, the sight of a mare does not occasion more than nervous tremblings, which are also produced by the ingestion of cold water. The voice diminishes in sonorousness and strength, and can only be heard a short distance away, sounding husky and nasal.

In Germany the symptoms differ in some respects, but are similar in others. The disease is usually localized at first in the mucous membrane of the urethra. The eruption of vesicles and the appearance of ulcers on the glans, penis, and scrotum, are somewhat rare; and if they do become manifest, their cure is usually prompt, only pigmentary stains being left at the points they occupied.

The diagnosis of the disease is, therefore, more difficult in the stallion than the mare, unless the local disturbance is accompanied by the secondary nervous symptoms already noted. Observation of the consequences resulting from coition, however, soon testifies as to the soundness of the animal; for if it has a chancre in the urethra, it will transmit the disease to the mares it has been put to, though apparently in good health.

According to Röll, the local alteration in the urethra consists in an increase in colour, and tumefaction of the meatus, accompanied by an exaggerated secretion of mucus. These, however, may disappear; though the horse is yet capable of

transmitting the disease. There are the symptoms of irritation in this region, as in the French cases, and the disease may continue a long time at this stage. Towards the end of the covering season, it may even seem to disappear altogether; but at the next season it will again manifest itself with increased violence.

In young and vigorous well-kept horses, the malady may also continue localized for a considerable period; but in those which are weak or badly attended to, the general or secondary phenomena are not long in appearing.

In the stallions, as in the mares, there are developed on the skin in different parts of the body, circular and flat swellings (the German "thalerflecke"); these are well-defined, and about the size of a shilling, and have not been observed in France. There is also paralysis of the posterior extremities, and finally of the lips, eyelids, or one or other of the ears. There is the same emaciation and exhaustion as in France; and death appears to be due to extreme debility, at times complicated with Pneumonia.

The same intolerable itching has been observed in Germany; and it is owing to its manifestation that Strauss designated this the "pruriginous disease of breeding-horses." It appears to be due to irritation of the sensitive nerves, and is most frequently observed in highly-bred animals. The skin is torn or rubbed off, and bleeding ulcers are produced; as the disease progresses, these ulcers sometimes assume a gangrenous character, increase in number, and the pruritis becomes more intense; so that, although the appetite may not fail, the animal usually perishes in a state of extreme marasmus.

Wirth, Erdely, and other German observers, mention ulcers as frequent on the genital organs, as well as efflorescent tumours.

COURSE AND TERMINATIONS.

As a rule, the progress of the disease is slow, and its termination most frequently fatal; though the result cannot always be predicted with certainty. With some animals which are apparently much advanced in the malady—even as far as the paralytic stage—recovery will at times occur; while

with others which are evidently only slightly affected, it progresses gradually to a fatal termination, in spite of all treatment.

It is liable to intermissions and remissions, or paroxysms. The swelling of the prepuce may be the only symptom for a long time, and this should arouse suspicion: especially if the horse has come from an infected locality; and particularly if there is weakness of the hind quarters, lameness, knuckling over at the fetlocks, and loss of condition, without impairment of the appetite.

The disease may continue from three months to three, four, or even five years. With four stallions which died at the Alfort Veterinary School, the malady lasted eleven months, a year and eight months, a year and eleven months, and two years and two months.

Viardot, who, as veterinary surgeon to the remount depot at Blidah, Algeria, had very good opportunities of studying the malady, gives, as the ordinary period of duration, from four to eight months in weakly soft animals; though he states that the period varies greatly according to the intensity of the malady and the constitution of the horses. In twelve stallions which perished of *El dourin*, the average period was ninety-one days. Vigorous, well-fed, good-tempered, and not too old horses, may frequently last, according to his experience, a year, fifteen months, two years, and even longer.

The emaciation, though general, is most remarkable in the hind quarters, particularly in the gluteal region; and sometimes one side is more wasted than the other. In France, towards the termination of the malady, it has been noted that the lymphatic glands have suppurated, and opacity and ulceration of the corneæ have been observed; as well as fracture of the ribs (perhaps caused by falling), viscid perspiration agglutinating the hair, and ecthymatous pustules on different parts of the body. The urine has also been remarked as thicker, and blood-coloured, at the last stage of the affection. At this period, too, the unfortunate creatures present the most pitiable aspect. What with the extreme emaciation, "the hideous marasmus;" the debility so extreme that the victims can no

longer stand, and their hinder limbs dropping under them, leaves them sitting like a dog, vainly endeavouring to maintain their equilibrium; the face haggard, and countenance pinched; the sunken eyes, expressive of terrible agony, which is made all the more sad by the futile attempts to rise; we have a startling picture of the effects of an equine venereal disease. Attempt to assist the unhappy brutes to rise, and it is discovered that they are no longer capable of standing on their hind legs, but with the greatest efforts can only remain seated; the breathing becoming deeper; the temperature lower; the heart's beats strong, but tumultuous; sensation so deadened, that the punctures made by a sharp instrument on the skin of the croup or hind legs excite no movement; until at last death interposes.

Not unfrequently Glanders and Farcy accelerate the final catastrophe.

PATHOLOGICAL ANATOMY.

The most striking pathological appearances in animals which have succumbed to this malady, are those due to emaciation and anæmia of the whole body. The subcutaneous cellular tissue has a yellowish tint; all the muscles, but especially those of the croup, crural, and lumbar regions, are pale and soft like boiled beef, their interstices filled with an abundant, yellow, gelatinous serosity not unlike the human syphilitic gummata; or these infiltrations are dark-coloured hæmorrhagic deposits, extending deeply into the tissue; not unfrequently, some of these muscles have undergone the fatty degeneration of chronic paralysis. The bones are brittle and easily broken, particularly the femur; and the cancellated tissue, as well as the medulla, shows large brown patches that contrast strikingly with the general yellow hue: these patches being found throughout the whole skeleton. The coxo-femoral articulations are much altered; their ligaments, as well as the pubio-femoral, are enlarged, red, softened, speckled throughout their substance, and sometimes torn. The synovial capsules and Haversian glands are injected and deep-red in colour, and the synovia is blood-tinted; while the diarthrodial

cartilages are yellow, softened, or have largely disappeared. The digestive, respiratory, and circulatory organs exhibit similar changes. With regard to the genito-urinary system, a section of the prepuce exposes a homogeneous, hard, yellowish tissue grating under the knife, and composed of fibrous material whose wide meshes contain a transparent serosity; the tunica vaginalis also contains a citron-coloured fluid, with not unfrequently whitish masses or false membranes adhering to the visceral layer. The spermatic cord is engorged, and studded with little, hard, calcareous granules occupying the blood-vessels. The testicles are healthy, atrophied, or hypertrophied; if the latter, they contain a yellowish fluid. The urethra also contains a yellow, viscid, and oily fluid; the mucous membrane is smooth, but more or less thickened and yellow, and it has been noticed to form a ring at the extremity of this canal; though in France it has not been found ulcerated, eroded, nor cicatrized.

The penis is partly without the prepuce, and is infiltrated, especially towards the glans: it is sometimes livid in colour, swollen, and surrounded by veins containing dark-coloured blood; and more especially towards its extremity, there have been observed numerous points about the size of a pin's head, which appear to be little coagula of dried blood. More rarely there are little white elevations—a kind of vesicles formed by the infiltration of serum beneath the epithelium.

In the mare, the mucous membrane of the uterus and vagina is thickened, injected, and of a reddish-brown tint; it is covered by a muco-purulent matter of a yellowish-white or chocolate colour, analogous to that which was discharged from the vulva during the course of the disease; sometimes there are collections of pus in the uterus.

The pelvis of the kidney contains a quantity of fluid like white of egg, and the lining membrane of the bladder is infiltrated, thickened, and yellow-coloured.

The subglossal, mesenteric, sublumbar, inguinal, preputial, and axillary lymphatic glands are increased in size, and some are red, while others have a yellowish tint: the former being

infiltrated by a thick purulent matter the colour of wine, and their texture soft and friable.

With regard to the nervous system, in some instances there are observed lesions which sufficiently account for the nervous disorder occurring in the last stage of the disease. In the brain there is not much alteration; the ventricles contain an amber-tinted fluid, and that beneath the arachnoid has the same colour and is abundant: in certain parts being also thick and gelatinous. The envelopes of the brain and spinal cord are injected, and the latter is softened to a considerable extent, especially towards the lumbar region, in the majority of cases; while the volume of the lumbo-sacral plexus and the sciatic nerves is increased through infiltration of the neurilemma.

These lesions, which have been observed in France, are far from being constant; and no microscopical examination has yet been made of the nerve centres.

The German authorities also describe the necroscopical appearances as similar to the above. Besides the emaciation and anæmia visible everywhere, they notice a constant infiltration and tumefaction of the neurilemma of the principal nerves; with a considerable infiltration in the vicinity of these nerves, as well as in the intermuscular connective tissue, of a yellowish gelatinous fluid. In many cases the spinal cord and brain are infiltrated, the arachnoid has lost its transparency, and sometimes contains a large quantity of yellow serum. In the stallion, the connective tissue of the prepuce and scrotum is frequently infiltrated, or has undergone sclerous degeneration. In the mare, there is remarked in the vagina, and at times also in the uterus, in addition to the characters of a chronic catarrhal inflammation, erosions, diphtheritic ulcerations, or condyloma.

The pituitary mucous membrane is generally the seat of Catarrh; the nasal cavities and the sinuses are filled with a viscid flaky mucus; the submaxillary lymphatic glands are enlarged, and at times contain pus; while the abscesses which are now and again met with in the testicle and spermatic cord, as well as in the lungs, appear to be due to metastasis.

DIAGNOSIS.

The disease is easier distinguished in the mare than the stallion in the earlier stages. Its contagiousness, the peculiarity of the symptoms (tumefaction of the prepuce, testicles, and penis), the character of the exanthema when it is present, and the nervous disorder, feebleness of the hinder extremities, and lameness, are all so many diagnostic guides, if taken in connection with the exudation, and notwithstanding the good appetite. When the circumscribed tumours appear on the skin, their situation and appearance, as well as the fact that they are confined to that membrane, should distinguish them from those of Farcy, which form *beneath* the skin. In the mare, the tumefaction of the vulva, discharge therefrom, persistent œstrum, restlessness, &c., ensuing after coition, should afford indications of the presence of the disease.

CONTAGIUM.

The contagium of this disease is "fixed," and from what is at present known of it, is only contained in the secretion of the genital mucous membrane (that lining the urethra of the stallion and the vagina of the mare), and in that of the vesicles or ulcers. It does not exist in the blood. It is inoculable, and at times very potent; but it does not appear to have any action on other than the equine and asinine species: though the hands of attendants have sometimes been affected with a mild vesicular eruption.

VITALITY OF THE VIRUS.

We have no evidence to guide us in forming an estimate of the vitality of the virus, or how long it may be present in the affected animal. Haubner states that in the mild form it is only present until the eruption disappears on the genital organs: within from four to six weeks; but that in the malignant form it may exist for more than a year.

INFECTION.

The contagiousness of this disease has been at times denied

by those who were not sufficiently acquainted with its history or nature; but there is now abundant proof that it is transmissible. This proof has been furnished by observation and experiment, and particularly by the careful researches of Lafosse of the Toulouse Veterinary School. The malady was entirely unknown in that part of France; and to ascertain whether it was contagious, fifteen mares belonging to regiments in the garrison, were put to four stallions purposely imported from the depot at Tarbes, where the disease prevailed. One of these stallions was a little emaciated, and was lame in the right fore limb; two others were in good condition, and had only slight swelling of the prepuce; while the fourth was perceptibly wasted, and the penis had a bluish tinge. Of the mares, five became slightly affected and recovered without treatment; but another five were seriously diseased, four of them dying. To render these results more conclusive, two stallions from the depot of Villeneuve-d'Agen, and which were quite healthy, the disease being also unknown there, were sent to Toulouse, and put to the mares infected by those from Tarbes. One of these animals soon manifested all the symptoms of the malady, and perished; the other was only slightly affected, and remained apparently in good health for four years, when it showed symptoms of Glanders and was destroyed.

At Tarbes, experiments have also been instituted to prove the contagiousness of this malady. A stallion which had been affected with swelling of the prepuce since 1856, but had not been used in 1857, was put to a healthy mare towards the end of 1858. This mare soon had tumefaction of the labia of the vulva, with pustules on their lining membrane, redness and thickening of that of the vagina, and the other symptoms of the benignant form of the disease; from which, however, recovery took place within five months. Another stallion which had been affected for a long time with a suspicious engorgement of the sheath, and which had been energetically treated with the actual cautery, &c., though without dissipating it, was put to an artillery mare, and not long afterwards she was more seriously diseased than the last: having, in addition

to the other symptoms, Catarrh of the uterus, and purulent discharges which had not disappeared in five months. The two stallions subsequently died of the disease at Alfort in eight months.

The German veterinarians, in addition to the French, have given numerous undeniable proofs of its contagiousness; and the Arabs fully admit that it is so.

It does not appear to be transmissible to other than soliped animals.

MODE OF INFECTION.

The disease is produced only by actual contact of the diseased with the healthy. Inoculation is rarely successful in producing it; Lafosse and many other experimenters have not been able to transmit it by puncture, nor yet by rubbing the mucus from the generative organs of an infected, into those of a healthy animal; though Hertwig has succeeded once in doing so. Perhaps if the attempts were made at the period of œstrum they would be more successful.

MODE OF ACCESS.

The contagium obtains access through the generative organs, and we have no evidence to show that it may be received by any other channel. It is transmitted from the stallion to the mare, or *vice versâ*, in the act of copulation; or it may be transmitted, according to Röll, from affected to healthy mares, or even geldings, if the contact of the genital organs is possible. The transmission is more easily and rapidly effected with the mare than the stallion, owing to the anatomical difference in their sexual organs: the character and large extent of the mucous membrane of the vagina being eminently favourable to absorption; while that covering the penis of the stallion being thick and covered with its sebaceous secretion, the contagium probably only obtains ready access by the urethra.

Repeated copulations are, of course, more likely to produce the disease than only one; and the highest bred animals are the most susceptible.

According to Haubner, men who handle diseased, and afterwards healthy, animals have been instrumental in spreading it, particularly by means of the sponges they have been using; though these cases are rare.

INCUBATION.

The duration of the latent period does not appear to be fully determined. According to Maresch, who studied the malady in Bohemia, it varies from eight days to two months. The mild form has generally, according to Haubner, an incubation stage of three to six days' duration; but in special cases in may appear in two, or not for eight or ten days. The malignant form, according to the same authority, may be longer than two months in appearing. Viardot gives it as from fifteen days to two months. Venereal excitement appears to diminish its incubation; as it also tends to induce its more rapid development when it has appeared.

EXTENSION.

The disease is propagated by diseased stallions or mares—most frequently the former; and in a country where the epizoöty prevails, it is nearly always possible to trace the infection of a large number of the latter to a few stallions. Consequently, it is most liable to become propagated in the spring time, when the generative organs are most active; and it is then, and in the summer months, that it prevails most extensively and virulently. In the second year of its appearance in a district, it is wide-spread, and in the third year it begins to decline in virulency. It always, however, spreads to adjacent localities by the transmission of the virus.

Owing to the long incubation and duration of the malady, it may be carried to the most distant regions by one infected animal.

From the figures at present accessible, it would appear that of the animals exposed to infection, about one-third become diseased. Cohabitation, without actual contact, will not produce the malady.

MORTALITY AND LOSS.

This may be said to be a very fatal and tedious disease; the recoveries being few and far between when it exists in the malignant form. Rodloff, alluding to its contagiousness and mortality, mentions that at the station of Sierakowa, one hundred and seven mares were put to diseased stallions. Out of this number fifty-four died, and the majority of the others had not recovered their health a year afterwards. At Tarbes, out of seven hundred and fifty mares put to infected horses, one hundred and twenty-seven became diseased, and fifty-two perished. In Prussia, at one station, fifty-eight mares were contaminated out of one hundred and fifty, and forty succumbed.

In another instance, out of three hundred and twenty-one mares the loss was one hundred and sixty; and of fourteen stallions, ten caught the malady and five died. We have given other instances of the mortality, and more might be adduced; but it may be sufficient to state that the loss is variable, though always very serious, and is seldom less than fifty per cent., rising even to seventy. The mortality is greater among the stallions than the mares.

IMMUNITY.

We have no information which could lead us to believe that one attack confers immunity from another; but it is very probable that, like human Syphilis—a disease which in so many respects it closely resembles—it does not do so: though repeated contaminations may diminish the disposition to become affected.

Neither do we possess any positive facts to enlighten us as to whether the progeny derived from infected stock are constitutionally deteriorated, as in Syphilis.

It may be remarked that Maresch mentions an instance in which a year-and-a-half old colt, then two foals, were infected by their dam, and not by any other mare.

There are many points connected with this remarkable disease which have yet to be elucidated, and the above are not the least important.

SANITARY MEASURES.

PERMANENT PRECAUTIONARY MEASURES AGAINST INVASION.

The permanent precautionary measures to be instituted against a disease of this description are of the very simplest kind. Horses or mares should not be purchased for importation in districts in which the malady prevails, without a careful inspection, or a veterinary certificate that they are free from the infection. As the disease is only propagated by actual contact, and in copulation, before newly-imported stallions or mares are so used, if the nature of the malady and its characteristic symptoms are known in the country, there need be no great apprehension of danger; as individual interests will be a sufficient stimulus to lead to the adoption of proper precautions.

The only source of danger lies in the introduction of the malady into a country where it is unknown, and cannot be recognized until too late to prevent mischief: as would undoubtedly be the case with England, where the existence of such a malady is perhaps as little dreamt of as was the contagious Pleuro-pneumonia of cattle and Aphthous fever, previous to 1839.

PROVISIONAL MEASURES.

As the disease is propagated solely by sexual intercourse, when it prevails in a country, the only provisional sanitary measures necessary are those which will prevent diseased animals from being employed for breeding purposes; at the same time giving notice of the existence of the disease, and the precautions to be adopted by those whose interests may be endangered. Above all, should the disease be suspected in any animal, the owner, or whoever else is responsible, ought to be compelled to report the circumstance to the proper authorities, as in the case of other contagious maladies.

In Austria, where the contagion has prevailed somewhat extensively for many years, the following regulations are in force :—

1. Even when there is nothing to lead to the supposition

that the disease exists, every mare which is to be put to the horse shall be inspected in the presence of the principal communal authority; and a rigorous refusal shall be given to all which are too old, or in a weakly condition, or which have a discharge from the vulva in any way different from that observed in mares only during œstrum.

2. The penis of the stallion intended to be employed for such purpose shall be examined at different times, and if it offers any lesion, no matter of what description—even if it has nothing in common with those of the disease in question—the animal must be excluded from use until perfectly cured.

3. There is every reason to make known to the breeders, by the most practicable means, the characters of this disease, so that they may be able to recognize it at its commencement.

4. If a breeding stallion is suspected, the owner, through the medium of the local authority, shall immediately make it known to the district administration, who will, without delay, order an inquiry to be directed into the circumstance, and prescribe the necessary measures.

5. In order to prevent the extension of the disease to other districts, the sale of breeding-horses shall be interdicted in the infected district during the existence of the disease.

6. If the malady has acquired a great extension in a country, the employment of all stallions for breeding purposes, whether they belong to individuals or to the State, shall be suspended. If any owner infringes this order, he shall be made liable to the penalties laid down in the Austrian penal code. The stallions recognized as diseased, if they belong to private persons, shall be sequestrated and submitted to proper treatment under the surveillance of the police.

7. Horses affected with the disease shall be separated from the healthy, and attended to by persons specially selected for the purpose; the necessary utensils shall not be used with other animals; and if the diseased are not deemed incurable, they will be submitted to treatment.

8. In order to arrive at a knowledge of the exact state of

the epizoöty, every eight days at least there should be a general revision of the equine population in the infected locality.

9. The horses attacked by the disease should be castrated; as well as those which, notwithstanding their apparent good health, have transmitted it to mares they have served; also those which have been put to mares affected with the malady when they were so served.

The epizoöty commission shall decide, without right of appeal, if it is necessary to submit a stallion to this operation.

10. The mares affected with the malady in its benignant form should not be allowed, even in the following year, to be served until after they have been inspected and declared healthy by a veterinary surgeon. The mares which have the disease in a malignant form shall, if they recover, be excluded from breeding, and shall be branded on the left side of the neck with a hot iron.

11. If the disease is complicated with Glanders or Farcy, the animals shall be submitted to the measures in operation against these affections.

12. The carcasses of horses which have died or been destroyed because of the malady, as well as the infected stables and utensils, shall be treated as prescribed for Glanders.

In Prussia, according to a ministerial decree of September, 1840, various measures are laid down for the suppression of the malady. Chief among these is that relating to the declaration to the authorities of its existence in stallions, and putting a special mark on those which are affected, in order that they may be recognized. They are not allowed to be removed from the locality within three years after their recovery. When the disease prevails in a district, its existence is made known by an official publication; after the issue of which no stallion is allowed to serve mares, unless its owner is provided with a certificate of health furnished by a veterinary surgeon, and not dating earlier than fourteen days. It is the same for mares; though their certificate should not be of a longer date than four days.

CURATIVE MEASURES.

In the majority of cases, the medical treatment of this disease may be safely attempted; though, as before stated, the chances of a cure are very uncertain, unless undertaken at the commencement of the attack.

With mares, the acute Catarrh of the vagina and uterus may be treated by emollient injections, and at a later period those of a mild astringent kind, especially preparations of lead; when chronic, weak solutions of sulphate of zinc or copper, or nitrate of silver, may be used. If there are ulcers, and they are within reach, they may be touched with the solid nitrate of silver or sulphate of copper.

In the stallion, when the genito-urinary lesions are noticeable, the same treatment must be carried out.

At Pilsen, in Bohemia, when the malady prevailed there, corrosive sublimate was successfully employed externally and internally, it is said.

In the mare, if the disease is complicated with mammitis, and suppuration is inevitable, this process should be favoured by every means, and blisters may be employed. When an abscess forms, it should be opened as soon as possible; and the same procedure must be adopted if abscesses appear elsewhere.

Should paralysis ensue, or other symptoms of nervous derangement, Röll recommends recourse to blisters; and should the phenomena be confined to one posterior limb, these counter-irritants must be limited to the part corresponding to the emergence and course of the sciatic nerves. Tonics, vegetable and mineral, should also be administered, with a good nourishing diet. Trelut appears to have been successful in some cases, by treating them with beef-tea and arsenious acid.

In stallions exhibiting symptoms of paralysis, the progress of the disease has been sometimes checked by castration; though the success of the operation depends upon the degree to which the paralysis has attained, and whether or not there

have been any local alterations in the genital organs at the time at which it has been performed.

In the last stages of the malady, when a cure becomes hopeless, the most profitable and humane procedure is to destroy the patient.

EXANTHEMA OF THE GENITAL ORGANS.

SYNONYMS—Technical : *Syphilis, Pseudo-Syphilis.* French : *Maladie Aphtheuse des Organes genitaux.* German : *Aphthen und Beschälausschlag, Phlyctanenausschlag, Eczemausschlag.*

GEOGRAPHICAL DISTRIBUTION.

It is very probable that contagious diseases of the genital organs are observed in the domesticated animal in every part of the globe. Their existence has been noted for a long time in Europe, and at present those which have been described are looked upon as the same disease having different forms. This malady has been more particularly studied in France and Germany, and Lafosse has given a good description of it. It does not appear to be much known in Britain ; though it may, nevertheless, be prevalent at times.

CHARACTER.

This is a contagious disease of the genital organs, in which the lesions are almost exclusively localized ; it is common to the male and female, affecting both solipeds and bovines, and assumes three or four distinct forms, but most frequently the pustular.

NATURE.

In its nature, this malady is more allied to the Gonorrhœa of the human species than perhaps any other disease that can be mentioned. It is essentially benignant ; is in the majority of instances transmitted in the act of copulation ; but can also be artificially induced by inoculation. It appears to be due to a morbid change effected in the secretions of the genital mucous membrane by too frequent coition, or constitutional derangement.

CAUSES.

The disease appears in the spring-time, during the coupling season; but it is difficult to explain its origin. Some authorities attribute it to too frequent copulation; while Sajoux, who described it many years ago, thought it was due to the use of stallions heated by excessive use, and whose ardour was maintained by stimulating food and drugs. But these causes do not explain why the disease should assume a contagious character; we can understand their predisposing to such a malady, but beyond its resulting from copulation, we are unable to account for its transmissibility.

Lafosse has remarked it to be most frequent with overexerted stallions, which are put to many mares in a brief space—particularly in those instances in which the horse and ass are used for the same mares about the same time.

The infected animals may transmit it to healthy ones by other kinds of contact besides sexual.

SYMPTOMS.

Three varieties of the disease have been described—an "ekzematous," "pustular," and "ecthymatous."

1. *Ekzematous Variety.*

Dayot has described this variety, which is chiefly characterized by the presence of ekzematous vesicles.

When the disease has not been induced experimentally, the symptoms are not apparent until it is well advanced; so that, in order to study its evolution and phases, recourse has been had to inoculation.

Induced in this manner, the disease commences with an eruption of spherical vesicles, which attain the size of a grain of millet or a hemp-seed, and become conical by extending their base before they reach the second period. An inflamed areola usually precedes their formation by a few hours; and they contain a serous fluid, which soon becomes thick and purulent. At times there is Œdema of the vulva.

In the second, or "crusty," stage, the vesicle has lost its contents, or these have dried up; it has become flattened, and really consists of nothing more than a little round crust, whose colour varies from a light to a dark brown. When this crust is removed, the membrane beneath is found denuded of its epithelium, though not congested, and exuding a small quantity of serous fluid, which dries to form a new crust. Not unfrequently the crust is shed, and leaves a small cicatrix, which remains without pigment for some time; in other cases, the membrane ulcerates at the centre of the spot where the crust has been: the ulcer spreading, but never extending beyond the circumference of what was the vesicle, though it may involve the entire thickness of the skin. Slow cicatrization is the ordinary termination.

The ekzematous eruption may be confluent or discrete about the vulva, whence it may extend to the vagina, the rectum, perineum, mammæ, and inside the thighs. In these cases there are large sores and inflammatory swellings, which may become so severe as to interfere with the discharge of urine and fæces, and the movement of the posterior limbs; in the worst cases there is fever.

In two or three weeks, should the animals be submitted to proper treatment, the malady disappears, the two first periods seldom lasting more than from four to six days.

The disease may manifest itself with similar characters about the lips and nose, in the mouth, on the eyelids, and their lining membrane. Abscesses sometimes follow the cicatrization of the ulcers, especially in the mammæ.

With the stallion, the first vesicles most frequently appear on the skin covering the penis and along the urethra. They are rarely confluent; though they nevertheless produce considerable ulceration, principally on the corpora cavernosa, the ulcers being larger than on the female genital organs. If the eruption occupies the whole of the penis, there is a period in the disease when the organ is so seriously ulcerated that it looks as if pieces had been punched out of its surface; while the inflammation may be so severe as to produce an amount of swelling at its free extremity that may lead to paraphymosis.

Dayot, who ably describes the malady, has never seen any of the numerous cases he studied perish from the disease.

2. *Pustular Variety.*

Latour has described this form. He saw a stallion which had about twenty small pustular tumours on the penis, chiefly on the right side and posterior face of the organ. In four or five days, after having acquired the size and shape of variolous pustules, these tumours opened and discharged a whitish fluid of such an acrid nature, that it produced ulceration of those parts of the mucous membrane with which it came into contact. The period of suppuration having passed, the pustules degenerated into ulcers, and in a short time the penis showed a very large number of sores larger than the end of the thumb.

The mares put to this stallion after the rupture of the pustules afterwards exhibited ulcers, but only at the margin of the vulva, and the parts which had been in contact with those on the penis; which appeared to prove that there was undoubted inoculation of the female by the male. Exploration of the vagina did not discover any lesion; neither was there any abnormal secretion.

Two other stallions in the same stable were affected, but less seriously.

Latour has seen the disease extend to the mammæ, which became inflamed, and abscesses formed in them. In some cases the malady has passed into a chronic state, and continued for eight, ten, or more months before terminating in recovery. In only one case was there a fatal termination, Glanders having supervened.

Sajoux states that sometimes there is at first manifested a violent inflammation of the vagina, in which phlyctenæ form and rupture, leaving red and violet-coloured ulcers; the inflammation extends to the mammæ, and then the heat and pain in the vagina diminish, its mucous membrane becomes dark-brown; but the vulva becomes emphysematous, the emphysema extending to the perineum and the posterior limbs. The urine then ceases to flow in a natural manner, and is passed involuntarily from distention of the bladder;

the surface of the body becomes cold, tremblings set in, and nervous movements; the perspiration acquires a cadaverous odour, and in two or three days the animals succumb to the disease.

3. *Ecthymatous Variety.*

For a very long time there has been observed in France, according to Lafosse, at the covering season, a contagious disease of the generative organs, which differs as much from the two preceding varieties as these do from each other.

In the female, the malady is first noticed at the vulva. In every case there forms on the margin of this opening, and in the folds of skin which attach the labia to the thighs, from four to ten days after copulation, hard, lenticular-shaped tumours, nearly half-an-inch in diameter, involving the whole thickness of the skin. These are isolated or agglomerated; if the former, the labia are not altered in volume; but if the latter, they are infiltrated, tumefied, and deformed. The affected parts are painful, especially after repeated copulation; a sero-purulent discharge appears, and frequently the epidermis falls off in the intervals between sexual intercourse; the whole looking, at this period, as if it had been dressed with tartarized antimony pomade: the vulvular eruption, after the impure connection, showing pustules very like those produced by this preparation.

Five or six days after the eruption appears, the matter contained in the derma, and which has been accumulated beneath the epidermis, becomes desiccated and crusty; so that, if not much interfered with, towards the tenth or twelve day succeeding the manifestation of the eruption, the inflammation has disappeared, and a small thin disc, the diameter of the tumour, is formed on the surface of each. This disc is at first very adherent, has a rough surface, and when quite dried up falls off, leaving in its stead a pale red circle or cicatrix in which the pigment is not deposited again, though incompletely, for several months, if it is ever renewed. During these alterations, the epidermis is detached in large patches, leaving red granular sores which secrete a purulent matter that dries and soils the parts.

As will be readily understood, physical influences frequently cause the removal of the crusts in process of forming; the sores then produced are finely granular, and from them exudes a yellow or reddish lymph that concretes, and forms on its surface a new crust destitute of epithelium, and rougher than the first. This in its turn is shed, and leaves the skin in the state above described. In rare cases the eruption reaches the anus, thighs, and perineum; and then an infiltration occurs in the latter region which soon extends to the mammæ, and is marked by œdematous swellings of various sizes and shapes. It is still more rare to witness the whole integument involved. Nevertheless, Lafosse has seen the ecthyma, accompanied by violent pruritis, extend to the whole of the skin, the patient furiously biting or rubbing itself whenever it had occasion to do so; the skin was excoriated over large surfaces, nearly everywhere hairless, and covered with crusts. Voluminous œdematous swellings appeared about the head and trunk; there was extreme emaciation, and the creature looked hideous. It required several months of the most careful and persevering medical treatment to restore the animal to health again, several intervening persistent attacks of Pruritis having delayed recovery.

In another case the hard tumours involved the entire thickness of the skin; they were round, but slightly painful, and appeared about the shoulders and neck; a crust formed at their summit, but they did not subside for more than a month after this was shed. In their course they behaved like the pimples of Acne.

When the eruption is discrete, the vaginal mucous membrane is unaltered; though it may be a little redder. When confluent, however, it is reddened and hypertrophied, and throws out an abundance of yellow viscid matter, which, lodging among the hairs of the tail, mats them together. This matter differs from that secreted during œstrum, which is milky-white, glairy, and less sticky, and is ejected at intervals, this act being accompanied by various characteristic movements; while that of the genital ecthyma flows constantly, without any movement or effort. The epithelium of the cli-

toris and the fossa navicularis is sometimes detached in small patches, which the discharge carries away ; the mucous membrane then appears deeply injected, the blood-vessels having a varicose appearance. An eruption similar to that on the labia is at times noted in the vagina.

In the stallion, owing to the penis being enveloped by the sheath, the course of the malady cannot be so easily followed, but it is no doubt analogous to that in the female ; though the friction during coitus will rather hasten the evolution of the eruption, by removing the epithelium covering the diseased points, exalting the irritation, and producing ulcers which are difficult to heal.

As a rule, it is only when the ulcers appear that attention is attracted to the disease. It is then discovered that they are most commonly situated on the sides of the penis, on and about the glans ; they are superficial, with regular or slightly sinuous borders, and are covered with a gray or yellowish purulent matter when copulation has not been effected for some time ; immediately after that act this matter has disappeared, and the ulcerated surface is of a bright-red colour. Discrete, and as large as a threepenny or fourpenny piece, the ulcers are sometimes arranged in groups of two, three, four, or more : thus forming a sore whose extent depends upon their number. The confluent ulcers usually lie on an inflamed and swollen base, extending to the connective tissue beneath. In the more serious cases, the sheath is infiltrated on one or both sides.

The ulcers have a marked tendency towards cicatrization, and the cicatrix contracts, leaving a wrinkled scar in which the pigment is more or less imperfectly regenerated.

With those stallions whose penis is of large dimensions—as the ass—if covering is not interdicted early, the ulcers multiply, penis, sheath, and urethra become acutely inflamed, and paraphymosis may be the result. The ulcers burrow deeply, and their margin becomes salient, callous, or fungoid ; the purulent secretion is increased, and erodes the parts it touches ; the organ itself exhales a fœtid odour, and when protruded it is found to be twisted in different directions, presenting a most

repulsive appearance. In this extreme condition, the glans of the sheath and groin are swollen: and in young animals abscesses may form in them.

COURSE AND TERMINATIONS.

This disease is generally benignant, and rarely leads to a fatal termination unless neglected: curative measures restoring the animals to perfect health. The best treatment, however, is not uniformly successful in bringing about a complete recovery.

When the ulcers have cicatrized, the engorgements may not entirely subside, and the penis, particularly around the glans, remains indurated and enlarged; so that it is impossible to retract it entirely within the sheath.

DIAGNOSIS.

This is easily established by the symptoms enumerated above.

CONTAGIUM.

This is "fixed," and is contained in the mucus discharges from the genital organs, but particularly in the matter covering the ulcers. We know nothing of the vitality of the virus, but it is in all probability not endowed with great tenacity; though its activity when recent is very great.

MODE OF INFECTION.

Infection occurs through copulation; the stallions which are affected communicating the disease to the majority of the mares they are put to, and these in their turn transmitting it to the healthy males brought into contact with them. It can also be conveyed in the act of sucking; as Dayot has furnished instances of transmission of genital ekzema in this way from dams to their progeny.

MODE OF ACCESS.

The contagium finds access by the genital mucous membrane; and also, it would appear from the instances just alluded to, by that of the mouth. In all probability it may

likewise obtain access by other mucous membranes, especially that lining the eyelids. It is readily inoculable, for Lafosse has repeatedly succeeded in inducing it in this way. By scraping the surface of the ulcers on the penis with a lancet, and depositing the matter so obtained beneath the epidermis of the labia of the vulva, or that of the vaginal mucous membrane, the symptoms have been developed in due course. In the first-named situation, there appeared on the skin, between the sixth and tenth day, pustules resembling those just described; in the second, the membrane became inflamed and thickened around the punctures, the epithelium was raised by a viscid transparent matter in the form of a small vesicle, which soon burst: the epithelium becoming detached, leaving a superficial ulcer gray in the centre and red at the edges, this ulcer increasing in size until it met those nearest to it. A yellow sticky mucus then flowed from the vulva, soiling the quarters, thighs, hocks, and tail; gradually the inflammation subsided, the ulcers healed, then the discharge ceased, and all the symptoms vanished. Analogous phenomena were witnessed when the matter from a diseased mare was inoculated on the penis or the urethral mucous membrane; the inflammatory process, ulceration, and morbid secretion were all noted, though the differest phases were not followed so regularly as with the mares; so that it could not be affirmed that the eruption on the penis was quite identical with that on the female genital organs.

INCUBATION.

The latent period of the malady is short, and varies from one to three weeks: most frequently the shorter interval.

EXTENSION.

The disease is extended almost entirely, during the covering season, by copulation.

MORTALITY AND LOSS.

This is infinitesimal, when suitable curative measures are resorted to.

IMMUNITY.

One attack does not confer immunity from another, it appears; and several repetitions of the infection may occur in the same animal.

SANITARY MEASURES.

PREVENTIVE MEASURES.

To prevent the disease, care should be taken not to allow the stallions to be over-exerted during the covering season, nor the mare too frequently covered by different stallions within a short time. Food of a highly stimulating kind should not be given, neither should such drugs as cantharides, pepper, &c., be administered. Cleanliness and attention to hygiènic measures should be observed.

SUPPRESSIVE MEASURES.

The chief measure for the suppression of the malady consists in preventing direct contact between the diseased and healthy animals. With this object in view, diseased stallions must not be used for covering purposes, nor healthy stallions permitted to go with affected mares. As it may, however, entail serious sacrifices to suspend the services of a good stallion at the time they are most required, and perhaps in a district where the loss cannot be compensated for by utilizing another, it has been suggested that, with such a benignant disease, a trifling precaution like that of smearing the genital organs of the male and female with some greasy substance, which might at least diminish the chances of infection, should be resorted to, provided copulation did not aggravate the symptoms, and the lesions did not oppose its accomplishment.

All direct contact between a diseased dam and her progeny should likewise be avoided, if possible.

CURATIVE MEASURES.

There is no difficulty whatever in curing this disease in its simpler forms, nature generally intervening to restore the

patient to a state of health, and art only expediting recovery by perhaps a few days. Cleanliness and cessation of copulation, emollient and astringent applications in the form of lotion or injection, are nearly always sufficient to bring every case to a favourable termination. If the inflammation runs high, gangrene and the formation of abscesses must be guarded against by the administration of febrifuge and purgative medicines, with topical astringents largely diluted.

Abscesses must be opened, or hastened in their development; and should paraphymosis occur, local bleeding in the form of scarifications, suspending the penis by a wide bandage around the loins, and the application of astringents and cold water, will be most beneficial. The ulcers, if deep and callous, should be dressed with caustics or the actual cautery.

The same treatment must be pursued when the disease extends to other parts of the skin. Should marasmus and debility set in, a liberal tonic diet must be prescribed.

In one case Lafosse had to secure the animal between posts, to prevent its injuring itself from the attempts it made to allay the extreme prurities affecting the skin, and until the remedies—preparations of sulphur or of tar—had accomplished this.

BOVINE APHTHOUS DISEASE OF THE GENITAL ORGANS.

This affection is peculiar to bovine animals, and appears in an epizoötic form. It was first observed by Numan, of the Utrecht Veterinary School, in 1831; since which period it has appeared several times in Holland and Brabant. It is contagious, even by cohabitation, as Numan's experiments prove; and he also mentions that a knacker contracted malignant pustule on the arm from skinning animals which had succumbed to the malady. From this and the symptoms, there is reason to believe that it belongs to the class of anthracoid maladies. The causes, beyond contagion, were unknown.

SYMPTOMS.

The disease is characterized by inflammatory tumefaction of the vulva and vaginal mucous membrane; the latter being studded with phlyctenæ, which, disappearing, leave the surface of a purple, or even a black hue. Most frequently there is no fever. In the male the inflammation invades the anus and rectum, and follows the same course as in the cow.

When the disease is more serious, there are violent fever, great thirst, loss of appetite, and cessation of rumination, abundant salivation, suspension of milk, and death quickly supervenes. As exceptional phenomena, Numan has noted general inflammation of the mucous membranes, bloody matters passed by the vulva and anus, contractions of the tail and eyelids, and the conjunctival membrane so injected that it looks like a clot of blood.

PATHOLOGICAL ANATOMY.

Partial infiltrations into the subcutaneous connective tissue and fourth compartment of the stomach, and the small intestine filled with a bloody fluid; the mucous membrane being inflamed, and even gangrenous. The inflammation of the rectum, vulva, uterus, and bladder, was less intense.

SANITARY MEASURES.

The segregation of the healthy from the diseased, careful disinfection, good hygiène, and care in the selection of food and water, appear to be the chief indications in a sanitary point of view. Precautions against the transmission of the disease to mankind must also be adopted.

CURATIVE MEASURES.

Numan adopted an antiphlogistic method of treatment, followed by astringent injections and lotions for the less serious cases. In those of a more formidable character, he administered a decoction of linseed, acidulated with hydrochloric acid, and by these means saved a large number of animals.

BOVINE GONORRHŒA.

This malady, in its general characters, is allied to the preceding forms, and is commonly known in this country, by farmers and others as "bull-burnt." It is a local disease, chiefly affecting the prepuce of the bull, and the vagina and uterus (in severe cases) of the cow.

CAUSES.

These are generally obscure, and may depend upon constitutional tendencies ; though there can be no doubt that undue copulation, inattention to cleanliness, and general neglect, will greatly increase, if they do not immediately excite, the malady.

SYMPTOMS.

These are very marked and distinctive. There is considerable pain manifested during the act of micturition, which is often attempted and imperfectly accomplished ; the animal is restless, stamps, jerks up the hind legs, lashes the tail, and moves from side to side, at times groaning and grinding the teeth. The pulse is accelerated and full, and constipation of the bowels is sometimes present. At first the discharge is slight, though it is soon increased, and thick, white, and corrosive ; there is also much tumefaction, the parts becoming of a deep-red colour. In neglected cases, the mucous membrane is divested of its epithelium, ulcers or chancres appear, and a bull may become totally useless from the formation of sinuses in the penis, and also from excrescences on it.

CONTAGION.

There can be no doubt as to the contagiousness of this affection, the discharge being the contaminating agent. Copulation alone disseminates the disease.

SANITARY MEASURES.

These are very simple, and merely consist in prohibiting copulation during the existence of the disease, and for a certain period after the symptoms have disappeared.

CURATIVE MEASURES.

The animal, if a bull, must be thrown down and turned on its back, the penis gently drawn from the prepuce as far as possible, well cleaned with tepid water, and dressed with some mild astringent solution. This treatment is to be repeated twice or thrice a week.

The cow does not require to be cast. The treatment must be the same, the lotion being injected with a syringe.

CONTAGIOUS FOOT-ROT OF SHEEP.

SYNONYMS.—Technical: *Paronchyia ungularis ovium maligna*, or *contagiosa*. English: *Foot-rot, Foul-in-the-foot, Hoof-rot, Foot-halt.* French: *Pietin, Pietin contagieux, Pietin Espagnol, Crapaud, Pourriture des Pieds, Mal de pied, Pied pourri, Mal de patte, Perogne, Inflammation carcinomateuse du tissue reticulaire du pied, Cutidite pustuleuse, Fourchet, Limace, Claudication.* German: *Bosartige Klauenseuche der Schafe, Chronische—, Spanische—, Französische—, Klauenseuche, Krümpe, Hinke.* Italian: *Limazurax, Zoppina.* Spanish: *Pedero.*

GEOGRAPHICAL DISTRIBUTION.

The geographical limits of this disease are not well defined. It has only been known in Europe since the end of the last century, and appears to have been first observed in merino sheep imported from Spain; though, from all the evidence offered—particularly that of Giesker and Gonzalez—it does not seem to be known in that country.

It was in all probability imported across the Pyrenees into France; for it prevailed extensively on the banks of the Gironde and in Lower Medoc, as well as in the Pyrenees, in 1791, when Chabert first described it as enzoötic in those regions. That authority designated it as the "crapaud du mouton;" though he confused it with all the other diseases affecting the feet of that animal, and did not recognize its contagiousness. Tessier also described it by the same name; adding, however, that of "pietin."

Some time afterwards it was observed in Central France. In 1805, Pictet gave an excellent description of it, and furnished evidence as to its contagiousness; and Gohier observed it from this period up to 1808, and likewise pointed out its transmissibility. Since that period, it has been studied in France by Chaumontel, Gasparin, Girard, Favre of Geneva, Huzard, Morel de Vindé, Veilhan, Sorillon, Reynal, and others.

It was reported as present in Piedmont; and it appeared in Germany in 1815 or 1816, where it was supposed to have been introduced by French merinos, and was designated accordingly (*Französische Klauenseuche*).

In that country it was well described by Letzius and Thaer. Since that period it has become greatly diffused by the improved merino breeds of sheep, which appear to have a predisposition to it. It has frequently spread in an epizoötic manner on the Continent.

The extent of its existence in this country cannot be accurately determined; though there can scarcely be a doubt as to its wide prevalence at times. Owing to faulty observation, it appears to be either confounded with the simple, benignant, or non-contagious "paronchyia interdigitalis" or "gravelling," or is altogether unrecognized; hence the continual disputation as to the contagiousness of "foot-rot." In consequence of this want of knowledge and discrimination in the mother country, we need not be surprised that as little is understood of the contagiousness or otherwise of "foot-rot" in our colonies or in the United States. In Australia, the sheep-rearing country *par excellence*, it appears to be very common. In the United States of America, according to the best authorities, and especially Randall ("The Practical Shepherd"), it is very prevalent among the merino sheep; much less so with the coarser varieties. Its contagiousness is well authenticated in that country.

CHARACTER.

This is a chronic inflammation and ulceration of the vascular structures of the feet, and more especially those of the purest breeds of fine-wooled sheep. It is characterized by lameness, separation of the hoof, and other pathological alterations; as well as the formation of a strong-smelling purulent fluid, which contains the infecting principle.

NATURE.

The nature of the disease is still a matter of dispute, some authorities contending that it is only a local manifestation

of the ovine Aphthous fever, and consequently contagious; while others are inclined to think that it is not a specific disease, but merely an inflammation due to the influence of certain morbigenous conditions, becoming enzoötic when whole flocks are exposed to these. As to its contagiousness, however, there cannot exist a doubt; and though certain influences may appear to effect its spontaneous development, yet it is at least specific in the sense that it can be transmitted.

CAUSES.

Beyond contagion, the presumed causes of this disease are doubtful and obscure. The causes mentioned are numerous, but the chief are long marches, want of attention to the hoofs, wet pastures, tall rank grass, standing on manure, sand and grit penetrating between the hoof and the living structures, dryness and heat of the ground, or its stony or sandy nature, feeding on oil-cake, &c.; in fact, conditions of the most diverse and contradictory nature have been ascribed as operating in the production of the disease. But though it may be admitted that it may be developed spontaneously, none of them can be proved to act in this way; some, however, may certainly be looked upon as favouring its extension. Among the predisposing causes, the aptitude of certain races—those of a delicate constitution—must not be overlooked. Damp, warm weather, as well as the nature of the pasturage, would appear to assist in propagating the contagion.

In America, the malady is most severe in the summer. It may be noted that Morel de Vindé attributed the disease to an animalcule which located itself in the space between the toes.

SYMPTOMS.

The disease at first affects one, two, or more of the feet; but ordinarily only one, and passes to the others. The earliest symptom is slight lameness of the limb affected, which is usually a fore one; though if examined, perhaps nothing unusual will be discovered. In a day or two, however, the hoofs will be found to be hot and painful on manipulation, and

particularly when the claws are separated; the skin around the upper part of the hoof and between the claws looks red; smooth pimples, pustules, or vesicles form; and a viscid, foul-smelling, cheesy-like or oily matter covers this part. If the skin be examined soon after this, beneath the exudation will be discovered a number of small ulcers, which contrast markedly with the whiteness of the adjacent parts and gradually coalesce; the discharge being yellow-coloured and sticky, and possessing a peculiar ammoniacal odour. In three weeks or a month, according to circumstances, separation of the upper part of the hoof has taken place towards the heel, and a greasy, dark-coloured, unpleasant-smelling fluid is secreted. The separation of the hoof goes on from before to behind—the sides, however, remaining unaltered; in about thirty to thirty-five days, the heel, in many cases, has nearly got well, but between the toes the ulceration has extended, is deeper, and causes great pain. If the loosened horn is removed, the living textures are seen to be swollen, of a bright-red colour, and covered with the same odorous matter already mentioned. The suffering is increased, and the sheep is dull and feverish; there is great lameness, and the animal cannot put the foot to the ground, or if several feet are affected it can scarcely stand. It consequently lies a great deal; or in grazing moves about on its knees when the fore feet are affected, or even on its abdomen. The disunion between the hoof and the parts being continued, the sole becomes detached, and the entire horny case comes off, or is only attached by a few isolated points of new horn. The hoofs thus detached may in time be reproduced, but only to be again shed if the secreting tissues have not completely recovered. In other cases, when the hoof is not shed, it happens that, in consequence of the irritation in these tissues, there is an exaggerated secretion of horny material, and the hoof attains a great size, is covered with rings, tuberous in shape, crooked and hard, and altogether deformed. The irritation increasing, an abscess not unfrequently forms in the region of the pastern, and if the malady continues suppuration becomes abundant and sanious; the tissues are slowly disorganized; fistulæ and purulent sinuses are established; the

tendons and ligaments are necrosed, and slough away in shreds; the pedal bone is involved in caries; the interungulate or biflex canal is inflamed and swollen, and suppurates; the pus reaches the articulation, the capsule of which is destroyed; and the second phalanx may be implicated in the mass of disease. In such cases the pain and agony are intense, and fever is continually present; the appetite is completely lost, the animal falls into a state of marasmus, and eventually dies.*

* Youatt and other writers in this country appear to have more or less mixed up all the diseases to which the foot of the sheep is liable, designated them collectively as "foot-rot," and believed this compound malady to be contagious or not, as chance guided them. Youatt's description of the disease, particularly its commencement, evidently pertains more particularly to the non-contagious form of Foot-rot. Professor Dick imagined Foot-rot to be due to the hoof growing too long, from keeping sheep on grassy lawns, moorish lands, or sandy soils, and asserted that it is not contagious; but every fact connected with the disease militates against his opinion. His observations, without any remark or comment, are all that is said of the malady in the latest English work on veterinary surgery.

Randall, an excellent authority on American sheep, which are chiefly merinos, thus describes the disease as it manifests itself in that country. After pointing out that the skin between the toes, when healthy, is firm, sound, smooth, and dry, and equally destitute of any appearance of redness or of feverish heat, he says: "The first symptom of Hoof-rot, uniformly in my experience, is a disappearance of this smooth, dry, colourless condition of the naked skin at the top of the cleft over the heels, and of its coolness. It is a little moist, a little red, and the skin has a slightly chafed or eroded appearance—sometimes being a very little corrugated, as if the parts had been subjected to the action of moisture. And on placing the fingers over the heels, it will be found that the natural coolness of the parts has given place to a degree of heat. The inflammation thenceforth increases pretty rapidly. The part first attacked becomes sore. The moisture—the ichorous discharge—is increased. A raw ulcer of some extent is soon established. It is extended down to the upper portion of the inner walls of the hoof, giving them a whitened and ulcerous appearance. Those thin walls become disorganized, and the ulceration penetrates between the fleshy sole and the bottom of the hoof. On applying some force, or on shaving away the horn, it will be found that the connection between the horn and the fleshy sole is severed, perhaps half way from the heel to the toe, and half way from the inner to the outer wall of the hoof. The hoof is thickened with great rapidity at the heel, by an unnatural deposition of horn. The crack or cavity between it and the fleshy sole very soon exudes a highly fœtid matter, which begins to have a purulent appear-

COURSE AND TERMINATIONS.

As the malady usually commences with one foot, the others only becoming involved successively; and as the disease may break out repeatedly in the same foot, even after the shed hoof has been replaced, its course is slow, and the morbid alterations may occupy four, six, or eight months before the animal perishes. The general condition is not much affected when only one claw, or even one foot, is involved; but when the disease progresses and reaches an advanced stage, and more particularly when more than one foot is implicated, then the fever, suspension of digestion, and emaciation rapidly induce a fatal result.

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ance. The extent of the separation increases by the disorganization of the surrounding structures; the ulceration penetrates throughout the entire extent of the sole; it begins to form sinuses in the body of the fleshy sole; the purulent discharge becomes more profuse; the horny sole is gradually disorganized, and finally the outer walls and points of the toes alone remain. The fleshy sole is now a black, swollen mass of corruption, of the texture of a sponge, saturated with bloody pus, and every cavity is filled with crawling, squirming maggots. The horny toe disappears; the thin, shortened side walls merely adhere at the coronet; they yield to the disorganization; and nothing is left but a shapeless mass of spongy ulcer and maggots. Attempts to cure the disease, the state of the weather, and other incidental circumstances, cause some variations from the above line of symptoms. When the first attack occurs in hot weather, the progress of the malady is much more rapid and virulent. The fly sometimes deposits its eggs in the ulcer, and maggots appear almost before—sometimes actually before—there are any cavities formed into which they can penetrate. The early appearance of maggots greatly accelerates the progress of disorganization. . . . . After the disappearance of the bottom of the hoof, the maggot speedily closes the scene. Where the rotten foot is brought into contact with the side in lying down, the filthy, ulcerous matter adheres to and saturates the short wool of the shorn sheep, and maggots, also, are either carried there by the foot, or they are speedily generated by the fly. A black crust soon forms, and rises a little higher round the spot. It is the decomposition of the surrounding structures—wool, skin, and muscle—and innumerable maggots are at work below, burrowing into the living tissues, and eating up the miserable animal alive."—*The Practical Shepherd*, p. 359. New York, 1871.

The disease is continuous in its progress, if not submitted to curative measures; though in the most favourable cases, and they are rare, a spontaneous recovery has been noted in a month or six weeks. If properly treated at its commencement, its progress is readily checked, and it may be cured before the first stage is passed. Left to itself, however, it may continue for months, even more than a year, especially if only a single claw is attacked. When, in these chronic cases, recovery does take place, there usually remain bony deposits, anchylosis of the joints, and deformity and deviation of the claws and hoofs.

It is only when the disease is extremely intense, and involves two or more of the feet, that death occurs in from six weeks to three months. Death is not a very common termination of the malady; nevertheless, external circumstances —such as heat, damp, foul pastures and sheds—have much influence on the course of the malady.

DIAGNOSIS.

The appearance of the diseased parts at the commencement; the fact that only one claw or foot is affected; and the gradual spread of the malady among the flock, in which it may continue for a long time; are certain distinctive features of contagious "foot-rot."

The origin of the disease, and the possibility of its being traced to a contagious source, are also worthy of consideration in diagnosing its presence. It might be mistaken for "enzoötic foot-rot" or "fouls," as it is sometimes termed ("paronchyia interdigitalis—" the "Klauenspaltenzündung," "Stalkrümpe," or "Moderhinke" of the Germans); this is not due to contagion, however, but to standing in wet, filthy yards, or on moist, marshy pastures, and disappears when the sheep are moved to a dry situation. It is marked by softening and removal of the horn and fissures in the hoof, the insinuation of sand and gravel, with more or less inflammation, and its consequences. Here the condition of the horn and its becoming fissured are very conspicuous; the interdigital parts are also first involved,

and frequently all the feet begin to be affected at the same time; it cannot be traced to contagion.

The disease cannot well be mistaken for the eruption of Aphthous fever, as there are no mouth symptoms, and the commencement of the malady is different; neither can it be confounded with "gravelling" or "travel-sore," as these present, especially in the early stage, very different manifestations. Erythematous inflammation, or ulceration of the biflex canal, is also distinct in its appearance from the contagious "foot-rot." In this affection there is lameness, certainly; but there is also tumefaction between the claws in front, separation of these, and a circular prominence or ridge at the entrance to the canal; from the latter escapes a fœtid, greasy, or purulent matter, and it very frequently contains foreign substances. "Mud-balling" (when mud lodges between the toes, and becomes so hard as to set up inflammation) is also easily distinguished from it. The history of the outbreak will probably aid in confirming the diagnosis.

CONTAGIUM.

The contagium is present in the exudation from the diseased foot, and may be termed "fixed." It is transmissible either directly through contact of the diseased with healthy sheep; or indirectly through litter, pastures, roads, railway waggons, or cattle-ships. It is also transmissible by "inoculation" of the morbid fluid at the coronets of healthy sheep. Indeed, though numerous observations had previously demonstrated that the extension of the malady was due to the presence of a virulent element, it was not until inoculation was resorted to that this was received as a fact. Pictet was the first (in 1805) to publish observations in this direction. He received two hundred half-bred merino sheep from Piedmont, some of which were lame from the disease. These were placed with a hundred other home-sheep on a low hill, where the pasture was dry and of good quality; but in a short time the latter commenced to have sore feet, and before long the whole three hundred were affected. The rams which joined them afterwards were also attacked. This occurrence

having been made public, attention was directed to the contagiousness of the malady, and similar occurrences were soon made known, especially by Girard. Gohier, to decide the question, undertook a series of experiments, after having published confirmative observations. He removed shreds of the loose horn from the claws of diseased sheep, and fastened them between those which were quite healthy; in this way he produced the malady. As the question was a serious one for the agricultural interest of France, the Agricultural Society of Paris offered premiums for the best essay on the disease, and these were awarded (in 1823) to Favre and Sorillon. The experiments successfully carried out by these authorities were perfectly conclusive. Favre, for instance, in one of his trials, simply deposited the matter between the toes of thirty-two sheep, and twenty-one became affected. Then followed observations and experiments by Letzius, Giesker, Felix, Mathieu, Delafond, Charlier, and others. Reynal has made numerous observations and direct experiments, which are entirely confirmative of all that had been previously published; so that there is no doubt whatever as to the existence of a virulent element in the disease, and that to this it largely owes its extension.*

* Randall entertains no doubt as to the contagiousness of the malady. Writing on the danger of public washing-pens, he says: "I have had four different visitations of Hoof-rot in my flock—all clearly and distinctly traceable to contagion. The third case occurred from some wethers affected by that disease, getting *once* among a flock of my breeding ewes. The wethers were found with the ewes at 9 o'clock a.m., and were not with them at night-fall the preceding day. They might, therefore, have been with them a few hours, or only a few moments. In the fourth case, half-a-dozen of my lambs and sheep jumped into the road when a lame flock was passing, and remained with them half-an-hour. Both lots of animals were thus exposed, when I was not aware there was a sheep having Hoof-rot in the town! The diseased sheep had just been brought in by drovers, and the farmer who took them to pasture, in the lot adjoining mine, in the third case, did not dream of their being thus affected,—and they had mixed with mine before I knew there was a new flock in the neighbourhood. I mention these facts to show how readily sheep contract the disease, and how idle it would be for any man to lay aside all fears of contagion in going to and occupying a public washing

VITALITY OF THE VIRUS.

The virus of Foot-rot appears to preserve its activity for a considerable period, though nothing definite has yet been arrived at in this respect.

INFECTION.

The virus does not appear to have any influence on other animals than sheep; no case of transmission, either naturally or by inoculation, having been recorded. Fine-wooled, high-bred sheep, as already noticed, are most readily infected, and lambs are also susceptible; those with coarse wool are not only less readily infected, but they are also more easily cured.

The power of the infection is shown in Favre's experiments, in which twenty-one out of thirty-two inoculated sheep become affected.

MODE OF ACCESS.

Infection takes place through the skin around the claws. There is no evidence to show that it can be produced in any other manner.

INCUBATION.

The incubation stage is from three to six days.

EXTENSION.

The disease is chiefly extended through traffic in sheep at the fairs and markets; by allowing diseased animals to travel in railway waggons and ships, and introducing healthy stock into these without a thorough cleansing having been carried out. Pastures on which affected sheep have grazed a short time previously, have also been known to cause the disease in flocks succeeding them. Indeed, we can scarcely realize any more

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pen—because he supposed he knew there were no diseased flocks in his neighbourhood. There could be no better place for contracting Hoof-rot or Scab, than a washing pen." *Op. cit.*, page 165. In another place (p. 357) he speaks of the disease involving as many as five thousand sheep in its different visitations.

certain mode of extension than that of depasturing healthy sheep with diseased, or where the latter have been a short time before. The grass imbibes the discharge from the suppurating claws, and especially from between them, where it is most abundant and virulent; and the healthy sheep, walking through the grass, must receive continuous applications of the virus from every blade, and on the very part where experiments have proved the skin to be most prompt and certain in absorbing it—between the toes.

Contact between, or mixing of, the sick and healthy, even for a brief period, on roads, at fairs, or on pastures, is also a prolific cause of extension. Litter, fodder, sheds, and stables must also be included among the media which harbour and convey the contagion. As has been remarked, the extension is facilitated by certain external influences.

MORTALITY AND LOSS.

The mortality depends upon circumstances; but unless gross carelessness or indifference is displayed, it should not be great. Nevertheless, through ignorance or apathy, this disease may cause sérious losses. If properly managed at its commencement, it will be easily eradicated; but when neglected or improperly treated, it may harass flocks for years, and lead to heavy damage. So that, from an economical point of view, it is a serious infliction, not only from the loss in condition which it occasions, but from its long duration in a flock. It is also a most painful disease, and entails great suffering upon the sheep.

IMMUNITY.

The immunity of individuals from a primary attack is not ascertained, but it is probable that few escape when fairly exposed to the contagion. One attack does not afford any guarantee against another; and it is not at all unusual for the malady to break out afresh in a sheep already partially or entirely recovered. Each attack, however, would appear to diminish the susceptibility.

SANITARY MEASURES.

PREVENTIVE MEASURES.

The measures for the prevention of this affection should be analogous to those for the prevention of "foot-and-mouth disease," or for "scab" in sheep.

Sheep should not be admitted from infected districts into other districts or countries free from the malady, except for immediate slaughter; and newly-purchased sheep should undergo a quarantine of eight to fourteen days before being allowed to mix with the home flocks. Should any among them evince lameness, and show other evident symptoms of the disease, they must be isolated; and those they have mixed or been in contact with should be carefully watched.

SUPPRESSIVE MEASURES.

When the disease appears in a flock, every animal should be carefully inspected, and the healthy separated from the diseased; as well as those which offer an increase of temperature and sensibility in a foot, or an exudation from between the claws. The healthy should not be allowed to go near the diseased or suspected; nor to travel by the same roads, nor drink at the same ponds; and they ought to be examined several times in the course of a week: those which offer the slightest indication of the malady being immediately transferred to the diseased portion.

Those which have been exposed to the contagion and yet remain healthy, should be made to pass through a sufficiently large trough laid down at some convenient spot, and containing chloride of lime dissolved in rain-water (one or two pounds for two buckets) to a depth of about four inches. If this is laid down at the entrance to the sheepfold, the sheep will be compelled to traverse it once or twice a day. If this cannot be conveniently carried out, then simple washing with the chlorine water may suffice.

The convalescent sheep should form a third lot, to be kept under observation and frequently visited for some weeks.

Should any relapse, they must be returned to the sick division.

After the disease has terminated, as a precautionary measure, all the manure should be removed from the sheepfold, and the floor of the latter should be dug up to a depth of six inches—this soil and the manure being deposited in some place inaccessible to sheep. New soil should be laid down in its stead. Or if this measure is impracticable, a thick layer of lime should be strewn over the ground. Walls, racks, mangers, and troughs should be carefully limewashed, or soaked in a solution of chloride of lime; and any buildings in which the diseased sheep may have been sheltered should, in addition to cleansing, be thrown open to the air for some time.

The flock should not be declared free from suspicion for a month or six weeks after the last case of recovery; and during this period, as well as during the existence of the disease, it should be kept apart from all other healthy flocks, and not allowed to frequent pastures, lanes, roads, or watering-places where these may come. The places it may have frequented should be interdicted for a certain time, so far as sheep are concerned.

Those who own flocks in a diseased locality should be careful in preventing all contact of these—mediate or immediate—with the infected.

The malady not being transmissible to other than the ovine species, so far as is known at present, no precautions have to be taken with regard to them.

CURATIVE MEASURES.

The measures to be resorted to for the cure of the disease are chiefly those of a surgical kind. Simplicity, economy, and a speedy recovery are the main objects to be kept in view. Recovery is prompt and certain if the malady is attacked at the commencement; but it is as difficult and uncertain if it has occasioned much damage and domiciled itself, as it were. When its existence is suspected or ascertained in a flock, the shepherd should not wait until the animals begin to limp, as by that time the disease may have made some progress; but

should frequently inspect the feet, and separate for treatment those which begin to show indications of its presence—heat and pain in the claws, and redness of the skin around the coronet and in the interdigital space, or the characteristic separation of the hoof at the coronet, and the discharge. At any rate, as soon as lameness appears, the cure of the disease should be at once commenced.

The diseased foot should be thoroughly cleaned, particularly between the claws; and if the horn has separated from the parts beneath, this should be carefully and gently removed by means of a small and sharp drawing-knife. If the horn is very hard during this and other stages of the disease, when extensive paring has to be carried out, it would be well to allow the sheep a run on dewy grass, immersion for a short time in a shallow stream; or if the cases are very few and the sheep valuable, to apply linseed-meal poultices. A most essential part of the treatment is the removal of all horn as soon as it becomes disunited; and as its softness is an important consideration, so far as the efficacy and rapidity of the operation and its painlessness to the sheep are concerned, it is always worthy of attention. A large and small drawing-knife (very sharp), and a pair of strong cutting nippers, are the only instruments necessary.*

* Randall's directions for paring the hoofs are practical and good. After advising that the sheep should be yarded immediately after rain, as then their hoofs can be more easily cut, he says: "The principal operator or foreman seats himself in a chair—a couple of good sharp knives (one at least a thin and narrow one), a whetstone, powerful toe-nippers, a bucket of water with a couple of linen rags in it, and such medicines as he chooses to employ, within his reach. The assistant catches a sheep, and lays it partly on its back and rump, between the legs of the foreman, the head coming up about to his middle. The assistant then kneels on some straw, or seats himself on a low stool at the hinder extremity of the sheep. If the hoofs are long, and especially if they are dry and tough, the assistant presents each foot to the foreman, who shortens the hoof with the toe-nippers. If there is any filth between the toes, each man, after first using a stick, takes his rag from the bucket of water, draws it between the toes and rinses it until the filth is removed. Each then seizes his knife, and the process of paring away the horn commences. And on the effectual performance of this all else depends."—*Op. cit.*, page 363.

At this early stage the treatment is simple. After well cleansing the parts, they may be powdered with sulphate of copper, or dressed with a mixture of that mineral and tar (Stockholm). A solution of chromic acid or bichromate of potash in water, in proportions varying with the intensity of the disease, might prove a useful application. From two to ten per cent. of the latter salt might be employed. Morel de Vindé has recommended, after a long experience, the 'application of nitric acid, and Delafond testifies to the good effects of this heroic remedy. It is applied to the diseased skin, as well as to the parts denuded of horn, by means of a feather impregnated with it. This is passed over the surface in different directions, until a slight fume arises, when it is stopped. The pustules are thus destroyed, and the surface is converted into an eschar. If the animal limped before the operation, in five or six hours after it the lameness disappears, and when the eschar falls off in seven or eight days, the cure is complete. Another heroic dressing, proposed by Derender, and preferred to the nitric acid by D'Arboval, is a mixture of nitric and sulphuric acids, one ounce of each, with crude opium, half-an-ounce. The opium is dissolved in a small quantity of water (two teaspoonsful), and is then added to the other ingredients. This quantity is nearly sufficient for one hundred sheep.

When the malady is in an advanced stage, removal of every portion of the detached horn is still more necessary, and the affected parts may be carefully dressed with the nitric acid, Derender's compound, or hydrochloric acid; or better still, perhaps, muriate of antimony. If the cases are very few, or the sheep are more valuable than ordinary, dressings of simple ointment, spread on tow, may follow the caustic applications. In six or eight days, this dressing is removed and the eschar along with it, when, if the sores have a healthy appearance, turpentine ointment alone may be applied; but if still unpromising, a repetition of the escharotic and ointment must be ordered. It is rare, however, that after a second dressing, recovery does not take place. Instead of these dressings, after the foot has been well cleaned and all the loose horn cut away, a semi-fluid mixture of chloride

of lime and water may be applied. Or the diseased surfaces may be dressed with nitric acid, and immediately covered with burnt oil (oil and sulphuric acid). An excellent dressing is a solution of sulphate of copper in water. This, when about four inches deep in a tub, and kept very warm, makes a capital foot-bath: the sheep being kept in it for from five to ten minutes, depending on the strength of the solution.*

This treatment will, in all ordinary cases, and when combined with collateral measures to be hereafter indicated, prove successful, and with a promptitude proportionate to the care and attention bestowed in carrying it out.

The remedies should be as simple as possible; and all complicated combinations of medicaments which, as will be observed in the majority of recipes, neutralize each other, ought to be avoided.

When the disease has reached a still more advanced stage, and the bones, tendons, ligaments, and joints may one or all be involved, in addition to the other structures, the veterinary surgeon must treat it on the surgical principles applicable to these conditions, and which it would be out of place to indicate here. It may be stated, however, that in these complicated cases, treatment is scarcely worth adopting, unless the sheep are valuable,—all others which may be in this sad plight, due to cruel neglect, should be killed and sold for what they may fetch.

In the cases in which extreme surgical treatment has to be adopted, it may be necessary to remove the whole of the hoof; and where there is necrosis, caries, and ulceration of the joints, which do not yield to any of the measures adopted, amputation of the affected phalanges may be resorted to: and with success, when only one foot is involved.

A valuable ram or ewe may in this way be saved, and its aptitude for breeding purposes be but little impaired. The end

* A common remedy in America, according to Randall, is the following: one pound sulphate of copper, quarter-pound (sometimes half-pound) acetate of copper, one pint linseed oil, one quart of tar. The two preparations of copper are powdered very fine, and many persons, before adding the tar, grind the mixture through a paint-mill.

of the limb, after the amputation, is covered by a thick cicatrix of a horny nature, and it is only exceptionally that it meets the ground : the animal travelling short distances, and grazing very well on three legs.

The removal of loose horn, and the application of topical remedies, are of no more importance than the collateral treatment that must be adopted. This consists in removing the animals from all those influences which may aggravate the disease, or annul the effect of the remedies applied. A dry, clean place should, if possible, be chosen for sheep with Foot-rot, and especially for some time after they have had their feet dressed ; and it would be well if they could be placed under cover until nearly or quite well. A roomy barn or stable with a good dry floor is best, and no manure or urine should be allowed to accumulate. The floor may be left uncovered in some instances ; but in other cases it will be found better to cover it with a thick layer of oat-straw, or, perhaps, better still, with pine sawdust or tan, to a depth of three or four inches. In this they ought to stand for one or two nights after dressing, and they should not be allowed to graze until the dew is off the ground, and then only on the shortest herbage : returning to the shed again before the dew falls. Muddy roads and damp pastures are particularly to be avoided. In summer, those dressings which contain Stockholm tar are most useful in keeping away the flies.

Internal remedies are not required, unless symptoms of constitutional disturbance are manifested. Bleeding and purging are recommended by those who do not understand the disease or its requirements.

USE OF THE FLESH OF AFFECTED SHEEP AS FOOD.

There can be no objection to the use of the flesh of sheep which have suffered from contagious "foot-rot," as it is quite innocuous. When, however, the animals are much reduced in condition, from the pain and inability to eat, or when in a state of marasmus, it is obvious that their flesh must have lost much of its nutritive qualities, and is therefore greatly inferior to the flesh of healthy sheep as an article of diet.

TUBERCULOSIS OF CATTLE.

SYNONYMS.—Technical: *Tuberculosis, Phthisis pulmonalis, Tabies mesenterica.* English: *Consumption, Wasting, Scrofula, Pining.* French: *Pommelière, Vieille courbature.* German: *Französenkrankheit, Perlzucht.* Italian: *Tuberculosi, Tisi.* Bengalee: *Jokkakas, Kyakas.*

GEOGRAPHICAL DISTRIBUTION.

Tubercular Phthisis, or Tuberculosis, probably prevails among the domesticated animals over the entire globe, though its frequency will depend upon various external influences, as well as the constitutional tendencies of different species and breeds. In some countries it is enzoötic and very destructive. Such is the case in densely-populated districts and in unhealthy climates, or in regions where animals are improperly fed and housed. In Mexico, for instance, it is very common, and causes much loss, about thirty-four per cent. of the animals slaughtered for food being found affected. In Europe, particularly in the cowsheds of the large towns and cities, it is extensively prevalent; and in this country it has long been recognized as a common disorder among animals, but more especially as affecting the bovine species.

CHARACTER.

The greatest importance at present attaches to this disease, from the fact that it has been induced experimentally in a considerable number of animals of different species —carnivores, herbivores, and omnivores—by inoculating and feeding them for a certain period with tubercular matter from the lungs and glands of diseased subjects, as well as their milk. When we consider how extensively this condition prevails among cattle whose milk is consumed as an article of diet—and particularly in rearing infants—

and whose flesh is used as food, no matter how diseased they may have been, it becomes a serious question whether there may not exist the gravest reasons for interdicting, wholly or partially, the utilization of the milk and flesh of animals so affected.

Pending further experiments and observations, no very definite conclusion can be arrived at; but with our present knowledge to guide us, we must be prepared to consider the question as a very important one, in which the welfare of mankind is largely concerned; and we are bound to ascertain all we can about a disease which, though known to veterinarians for many years, has not until recently been suspected of possessing transmissible qualities. Therefore it is that it finds a place in this work, as a virulent disease.

Tuberculosis is most frequent in cattle; it also affects, though extremely rarely, sheep and pigs. It is seldom observed in solipeds, and is almost unknown in carnivores. It is characterized by the deposition of tubercular matter in the lungs and other organs, wasting of the tissues, and other signs of imperfect or mal-nutrition, which leads more or less rapidly to a fatal termination: the tubercular matter undergoing various characteristic changes, according to the length of time it has been deposited, and modifying the symptoms accordingly. The progress of the malady is slow, and its commencement insidious.

NATURE.

This is a disease of mal-nutrition or mal-assimilation, and may be said to be almost peculiar to the bovine species. Experiment has shown that it can be produced by inoculating or feeding animals with the morbid product: tubercles being formed in the lungs and other viscera of animals so experimented upon, the deposition of tubercular matter in this malady not being confined to any particular organ.

CAUSES.

The etiology of Tuberculosis has been much discussed. There can scarcely exist a doubt as to its being hereditary:

this constitutional taint being remarked in different breeds, as associated with a particular physical conformation and temperament. Sex would also appear to be a predisposing element in its production, cows being by far the most frequently affected. Animals of a lymphatic or nervo-lymphatic temperament, attenuated figure, long limbs, and narrow chest, are apparently those most liable to be attacked, or to produce stock which will be phthisical. Independently of these hereditary influences, however, there can scarcely be any hesitation in affirming that certain external circumstances will either directly or indirectly lead to the development of the disease. Such influences as dark, filthy, and badly-ventilated dwellings, food insufficient in quantity or defective in quality, fatigue, excitement, &c., have been invoked; but there are two causes which appear to be most potent in its production: these are prolonged and excessive lactation, and a cold and damp atmosphere.

Cattle kept solely for dairy purposes, and particularly in large towns, suffer by far the most severely from this affection. Constantly confined in stables which are not always well ventilated and clean, deprived of exercise, drained of milk in large quantities, and fed on the kind of aliment which most favours the increase of that fluid—though it may not enhance its quality—it cannot be wondered that the nutritive functions of the cattle so treated must suffer to a serious extent. Indeed, it is a matter of daily observation that the cows which are abundant milkers are most liable to this disease.

A cold atmosphere, and especially if it be also damp, is almost certain to induce the malady in cattle brought from a warm or mild climate. This has been observed for a long time in other than bovine animals, but Sanson and Reynal draw attention to one striking instance occurring in France. A number of the South Devon breed of cattle was imported to the experimental dairy of Saint-Angeau, in Auvergne, which is situated at a high altitude; but all these, as well as their progeny (a cross with the *Auvergnates*), were gradually swept off by Phthisis, evidently induced by the unaccustomed

cold, which they were incapable of resisting. So numerous were the cases of Tuberculosis occurring among these animals, that local observers believed the disease to be contagious. Röll also remarks that cattle reared in mountainous districts, when transferred to low-lying, damp plains, are very liable to be affected with Tuberculosis. Young animals are more predisposed than old.

SYMPTOMS.

The progress of tubercular Phthisis is sometimes acute, but it is most frequently chronic; and its symptoms in the milder cases are not always particularly well-defined. They may, however, for facility of description, be divided into three groups, each belonging to a stage in the course of the disease.

First Stage.

The insidiousness of the malady at its commencement renders its primary phenomena obscure and inappreciable, and it may have been in existence for months before the earliest external manifestations can be fixed upon. As Reynal points out, those who are in the habit of visiting slaughter-houses will often have occasion to note the presence of tubercles in the lungs of cattle which, during life, would not have been suspected of suffering from an incurable malady. When living they must have appeared perfectly healthy, and have fattened as if nothing whatever had been amiss with them.

The first perceptible signs are generally dulness and indifference, and less activity and energy. There is heightened sensibility in the skin, especially that of the withers, back, and loins, where, if it is pinched, the animals shrink in a very marked manner. This exaltation of the sensibility is further demonstrated by the occurrence of an exaggerated sexual desire—a species of nymphomania—marked by continual or frequent periods of rutting: such animals being commonly known in this country as "bullers" (*taurelières* in France). These, however, do not readily breed, and the fœtus rarely comes to maturity. At the same time, the animals will fatten,

or yield as much milk, as if they were quite healthy. The milk, however, is deficient in quality: it is more watery, bluish-tinted, and contains a larger proportion of alkaline salts; but it is less rich in nitrogenous matters, and fat and sugar, than in health, proving that assimilation is defective.

At the same time, there is emitted a dry and deep, though feeble cough, that comes on when the animal is passing from a hot to a cold atmosphere, or *vice versâ*, when undergoing any exertion, or when the trachea is compressed: merely indicating that the mucous membrane of the air-passages is congested and irritable. This cough is not generally accompanied by expectoration or nasal discharge; though exertion may cause the flow of glairy mucus streaked with thick flakes, which accumulates around the nostrils, more particularly towards the next stage of the malady.

The walls of the thorax are more sensitive on percussion than in health, evidenced by the animal trying to evade this operation, and emitting a slight grunt during its execution; though this means of investigation furnishes no other indication. The respiratory murmur is sometimes remarked, on auscultation, to be rasping and harsh in its sound, or loud and blowing. These differences are, of course, more marked in some parts of the lungs than others. The circulation is at times hurried—the heart beating strong and quick, and the pulse is tense. The skin is hot and dry, particularly towards the base of the horns and ears; and slight febrile attacks are noted, especially after fatiguing exertions. Intermittent epistaxis; lameness of the limbs, which not unfrequently wanders from one to another; enlargement of the lymphatic as well as the parotid glands, likewise accompanies the other symptoms, and still further characterizes the malady. The temperature, according to thermometrical observations, is but little increased throughout the disease.

This period is variable in its duration, and may extend over months; in other cases, from the operation of casual influences, such as sudden chills, severe labour (in working oxen), or hardship of any kind, it is shortened, and the next stage is reached. In some cases the glandular enlargements

—especially of the parotid, inguinal, and axillary glands—are very marked.

Second Stage.

At this stage there can no longer be any doubt as to the presence of the disease, as all the previous somewhat obscure symptoms have become intensified, and new and really pathognomic ones are added thereto.

There is evident emaciation, and the animals are heavy, apathetic, and sluggish in their movements; while the countenance is without animation and dull, and the eyes are retracted in their orbits. The skin is harsh and dry, and adheres closely to the ribs, and the hair covering it is lustreless and staring, and frequently damp. Trifling exertion produces abundant perspiration and laboured respiration, and so much lassitude and distress that the animal seeks to relieve itself by carrying the head close towards the ground; while the attitude of the limbs betrays the debility from which it suffers. Advanced anæmia is indicated by the appearance of the visible mucous membranes, which are of a pale-yellowish tinge and infiltrated. The appetite is diminished and capricious, and digestion is irregular, weak, and accompanied by more or less tympanitis soon after feeding; not unfrequently constipation is alternated with diarrhœa. The milk is markedly diminished in quantity and quality, as already mentioned, being blue-coloured and watery, and poor in nitrogenous matters, butter, and sugar; but rich in mineral constituents, particularly when the cows receive large allowances of grain and bran, or meal.

Cows nearly always abort; and this accident aggravates the other symptoms, and causes death. Even if the natural period is reached, parturition produces the same untoward results; while the progeny is sickly, puny, and bears the germs of the disease.

The cough is easily induced by pressure on the trachea, and occurs spontaneously at short intervals: being accompanied by the expulsion of viscid muco-purulent matter which sometimes contain yellowish-white, cheesy-looking flakes. This discharge usually has no smell; though it may at times

exhale an offensive odour, as if it had commenced to putrefy in the lungs.

The breathing is now increased, even when the animal is at rest, and the respirations are interrupted as if pulmonary emphysema were present; though usually this is not always very marked. Percussion gives dulness in some parts of the chest, and in others the normal resonance: as if the surface of the lungs was studded here and there with solidified patches. Auscultation discovers the respiratory murmur to be loud in some parts, and dull or lost in others; or there are heard in places abnormal sounds—such as mucous or sibilant *râles*, or loud bronchial bubbling noises: though these are far from being constantly present, and depend a good deal upon the effects of the cough. In other cases, which may be fairly designated the "dry" or "calcareous form" of the disease, there are dry crackling sounds mixed with a harsh laryngeal blowing: indicating a parched condition of the bronchial mucous membrane, and the existence of interlobular and vesicular emphysema; at the same time the cough is feeble and dry. Certain portions of the lungs manifest these alterations more than others, because they are most disposed to become the seat of tuberculization. These are the anterior appendix of each lung (which may be readily auscultated by carrying the fore limb well back, so as to expose the first ribs), and the middle zone immediately behind the shoulder, and as far as the ninth or tenth rib. In the upper zone the supplementary vesicular murmur is nearly always heard, but in the lower it is lost. The heart's beats are strong and audible; the pulse is, however, small and thready; and the superficial lymphatic and parotid glands have still further increased in size; while indurated painful swellings cause persistent lameness. There is also sometimes intense fever, profuse sweats, dyspnœa, and prostration, and a general exacerbation of all the symptoms.

Third Stage.

In this all the symptoms just enumerated are exaggerated to their highest degree. The emaciation is extreme and debility great, and this is accompanied by a more or less intense

hectic fever, which persists with but a few hours' remission during the twenty-four hours. The cough is harassing, and the back is arched, the head low and protruded, the mouth partially open, and tongue pendulous; the horns, ears, and limbs are cold; a prolonged moan is emitted in respiration, and the inspiration is irregular and gasping; while there is a dark-coloured fœtid diarrhœa, and not unfrequently considerable impactment of the rumen, which can be felt in the left flank.

Percussion does not yield any other indications than those already noted, but it causes the animal to evince pain. Auscultation reveals the existence of various pathological *bruits* connected with the lungs or pleura: such as sibilant, humid and bronchial, cavernous and amphoric, and sibilant and gurgling laryngeal sounds.

The mucous membranes have become extremely pale; the heart's action is tumultuous, and the pulse almost imperceptible; there is often œdema of the dependent parts; and, though rarely, ulceration of the joints and glands, in consequence of softening having taken place in their swollen texture. The miserable creature, if permitted to live beyond this period, dies in a state of extreme marasmus.

In the second and third stages, tubercular Phthisis is sometimes complicated with broncho- or lobular- Pneumonia, or pleurisy, caused by perforation of the serous membrane of the lung, which quickly leads to a fatal termination. In other cases, in consequence of tubercular infiltration into the bronchial glands producing disturbance in the function of the recurrent nerves, the breathing becomes stertorous, and dyspnœa is urgent.

COURSE AND TERMINATIONS.

As has been remarked, unless serious complications arise, this is a protracted malady, and may exist for months without causing a serious disturbance—running a subacute or chronic course. When the food is appropriate and regularly given, and hygiènic measures are duly observed, six months, a year, or even a longer period may elapse before the symptoms

become at all marked; but the disease, nevertheless, makes continued progress towards the destruction of the organs it has attacked.

The instances in which there appears to be a check in its progress, due to calcification and enkysting of the tubercles, and which leads to the belief that recovery is possible, are extremely rare, and never of long continuance; for the least failure in hygiène and feeding, or exposure to unfavourable external influences, will rouse it from its latency, and hurry its progress in a very exceptional manner.

The disease always terminates fatally, if the animal be permitted to linger on: its course being more or less rapid, according to the physiological importance of the organ or organs involved.

PATHOLOGICAL ANATOMY.

The lesions of bovine Phthisis are essential, and accessory or contingent. The "essential" alterations comprise tubercles, and closed vomicæ resulting from central softening of these; the "accessory" lesions consist of acute or chronic inflammation of the pleuræ, Bronchitis with cavernous dilatations, lobular Pneumonia with purulent infiltration terminating in small indurated abscesses, and gangrenous cavities, the result of Pleuro-pneumonia. These contingent lesions are, as their designation implies, not invariably, though they are frequently, present; they are not a necessary effect of the disease, but, in the opinion of Reynal, the result of epiphenomena added to the fundamental lesion, without forming an integral part of it.

The essential characteristic of the disease—Tubercle—is found, in advanced cases, to be extremely developed, and to affect many organs and textures. In the lungs, the tubercular matter appears to be first deposited in the cortical or peripheral portion, and always in the sub-pleural and interlobular connective tissue. There the nodules are multiplied, and gradually extend deeper: forming numerous ramifying branches that first compress, and ultimately completely efface, the air-cells; in this way isolating considerable portions of the

lungs, which eventually become wasted, and are replaced by the morbid product. These tubercular masses may become so numerous and so developed, as to increase the pulmonary lobes to thrice, and even five times, their weight—diseased lungs sometimes weighing forty, fifty, and even sixty pounds.

Trasbot, quoted by Reynal, has made a special study of the pathological anatomy of bovine Phthisis, and appears to have accurately defined its characters. Recognizing the fact that the essential element is the small, round, miliary tumour which is developed in the lungs, pleura, lymphatic glands, and other organs, he considers it in its early stage, and afterwards in its various phases of transformation—softening and calcification.

The recently-formed tubercle is a little nodule, generally spherical when isolated, and varying in size from a point scarcely visible to the naked eye, to that of a grain of millet or hemp-seed. This is contrary to the statement of the majority of authorities, who assert that it may acquire the dimensions of a hazel or walnut, or even larger. Trasbot's careful examination of tuberculous tissue, led him to believe that the largest tumours are formed by the mere aggregation of the small miliary masses, which can be separated by careful dissection. Each little mass is dense, tenacious, scarcely elastic, and difficult to crush or tear—a proof of the intimate cohesion of its constituent parts; it is, besides, very difficult to separate it from the surrounding tissues, and it is never enkysted, as has been so frequently stated. There is, on the contrary, a perfect continuity between it and these tissues. Its colour is at first a grayish-white, and it is semi-transparent; but when fully developed, it is somewhat yellow and opaque. As already remarked, when isolated and not compressed during its growth, it is always regularly rounded; and if it is formed in the texture of a serous membrane, it constitutes a small hemispherical eminence of a characteristic shape on the surface. But when a number are clustered in a single mass, they are somewhat polyhedral from pressure, and the tumour they form is finely nodulated externally.

Histologically, when a tubercle at this early period is

examined by a low magnifying power, it is found to be developed along a small artery, most frequently at the angle formed by a terminal division of the vessel ; sometimes around a capillary, on which it forms a kind of bead ; or in the network of an anastomosis, which envelops it on every side. When this little mass is broken up and inspected by higher powers, it is discovered that the whole is composed of nucleated cells, absolutely identical with the fibro-plastic elements of Lebert and Robin, and a connective substance with thick filaments, which closely unites them. The fibro-plastic cells are very large (0·006 to 0·007 parts of a millimetre in diameter), which Trasbot thought corresponded to the normal volume of those of the ox, whose tissues are less dense and not so fine as those of other animals, such as the horse ; they contain one or more voluminous oval nuclei, which resist the action of acetic acid. The free nuclei are nearly all spherical or oval, and similar to those in the interior of the cell ; and their number is great in proportion to the rapidity of the morbid process. There is nothing peculiar in the connective fibres, which appear to be merely pre-existing tissue.

There is never observed the small, round, wrinkled, granular, and opaque cells (the "cytoblastions" of Robin), which always form the central portion of the tuberculous granule of man, and which Lebert considered as heteromorphous and specific. Trasbot is of opinion that the tubercle of mankind and that of the bovine species are quite different in an anatomical sense ; though they may appear to be similar on a casual or incomplete examination. We shall allude to the evidence of other observers with regard to this supposed dissimilarity presently.

When the tubercle is fully developed, it contains no vessel in its interior : no trace being discovered of the capillary, which was doubtless destroyed by the transformation taking place around it. The nutritive material must, therefore, be carried exclusively by the surrounding vessels ; and it is always observed that these are more numerous around the nodules, and in the septa or interstices of the large masses of tubercle, than

in the healthy connective tissue; there the vascularity is oftentimes so great as to be mistaken for inflammation.

This absence of vessels in the tissue of tubercle serves to explain why, nourished exclusively at their periphery, they have only acquired small dimensions before the central necrobiosis commences; and this special peculiarity distinguishes them from sarcomatous tumours, with which Virchow has unrestrictedly assimilated them. Doubtless, according to Trasbot, the elements of both are alike; but the absence of nutrient vessels in the first, and the fact that it cannot exceed a certain determinate volume, should distinguish the bovine tubercle from the sarcomatous tumour; and this authority, denying also that is has any relation to human tubercle, asserts that it is a *lésion-type:* having a distinct form and individuality, belonging exclusively to one species of animal, and incapable of being transferred to another.

This capability of transference, however, we will consider presently.

The enormous masses of tubercular matter so often met with are not composed of only one tubercle—for we have said that this is always limited in its volume—but of multitudes; around the primary miliary nodule are soon formed others which acquire the same volume; these are surrounded, again, by those of more recent growth, and so on incessantly until the end; so that each mass or aggregation of tubercles, nodulated and everywhere added to by new productions, increases indefinitely, and at last may weigh several pounds.

The tubercles so developed undergo successive modifications, which so alter their character, that many observers have denied their identity. The first of these alterations, which occurs in certain conditions, is "calcification," or impregnation of the tissue with earthy matter. This may be general or partial, and may exist in various degrees in the same mass. The calcified tubercle has usually attained its maximum size—from that of a hemp-seed to a small pea; it is yellowish-white, perfectly opaque, very hard, and feels like a little stone in the tissues; it is crushed with difficulty, and then appears

to be a mass of chalk, and it grates under the knife when an attempt is made to cut it.

When divided, the section shows a central portion—the most considerable, but irregularly defined, and quite petrified—and an external, yet fibrous in its nature. This appearance doubtless led casual observers to believe that the tubercle was enkysted; but the enucleation supposed to have taken place on pressure was only the result of rupture of the abnormal tissue surrounding the infiltrated portion.

At this stage the tubercles are never isolated, but are collected in various-sized masses which are fixed in the intermediate connective tissue supporting the capillaries. The earthy matter would appear to be composed of two calcareous salts; and after its disintegration by acetic and hydrochloric acids, there remains the *débris* of the cells already described, and especially the oval nuclei, the majority of which are intact.

This calcification appears to commence in the cells; as in those which are undergoing the transformation there is seen a portion—particularly around the nucleus—which is quite opaque, and the addition of hydrochloric acid causes a slight effervescence, the disappearance of the opacity, and the appearance of the nuclei. It is not improbable that the calcification may also take place in the intermediate connective tissue.

Another modification in the tubercle is "softening," which occurs whether calcification has or has not taken place, and consists in a granulo-adipose degeneration (the "necrobiosis" of Virchow) which terminates in caseous softening (*ramollissement caséeux*). This alteration commences at the centre and extends towards the circumference of the tubercle, until there remains nothing but the surrounding connective tissue; and its appearance would lead superficial examiners to think it was enkysted, as it forms a badly-defined cavity, the contents of which are easily detached. Sometimes several contiguous tubercles break up simultaneously, and the septa between them disappear, leaving cavities sometimes larger than a walnut. These vomicæ are of various shapes and dimensions, and are often confounded with other cavities which are formed in a very different manner.

The vomicæ have no proper walls, but are merely surrounded by the more or less indurated connective tissue that constitutes the stroma of the tubercular masses, and their interior is not vascular like that of cavities resulting from inflammation. There is no natural demarcation between them and their contents, as in kysts and abscesses, the gradation being insensible. The central matter is more or less coherent, according to the degree of softening at which it has arrived; it is white and plaster-like, if calcification has already occurred, and has a grayish-yellow colour and cheesy consistencey in the contrary case. It is this cretaceous or pyoïd detritus which was formerly improperly designated "tubercular matter." It has really no special characteristics, and resembles the contents of any kind of chronic tumour or indurated abscess after the total absorption of the fluid portion of the pus, or that of an atheroma.

Histologically, this softened matter of the tubercle has a different appearance, according as it is mixed or not with calcareous particles. In the former case, with the earthy matter are seen fat granules, but these are alone to be found when calcification has not preceded softening. They are very small, gray in outline, and transparent in the centre: resisting the action of acetic acid, and only soluble in ether. They are isolated or in clusters. The process of degeneration is exactly that which occurs in all pathological tissues that cannot be absorbed or destroyed by suppuration.

With regard to the situation of the tubercles, we have stated that all the serous membranes are liable to be their seat; though all are not equally disposed. The pleura is always affected, the peritoneum frequently, and the other serous membranes rarely. Those of the pleura always commence in the texture of that membrane; they are extremely fine at first, but they increase in size and multiply, coalesce, and finally form smooth masses covered on their free surface by epithelium. In shape they are sometimes tuberous and mammillated; or like clusters of grapes, more or less confounded at their base, or completely separated, and suspended, as it were, by vascular peduncles, giving the membrane a most diversified appearance. At other times, all the free surface of the two layers is studded

with round tumours, formed by one or a multitude of tubercles, varying from the size of a pea to that of an apple (hence the popular designations of *pommelière* in France, "angle-berries" in Scotland, and "Perlsucht" in Germany). Not unfrequently, those on the visceral layer are joined to the vegetations on the parietal surface, so that the lung is really attached to the ribs by adhesions of a more or less rigid character, according to the duration of the disease. These pleural tumours are not unfrequently so large that they weigh twelve or fifteen pounds, and may exist in the three states just described; the new tubercles being external, the cretaceous in the middle zone, and those which are undergoing softening in the interior of the mass. The pleura itself is thickened, indurated, and much more vascular than in health.

We have described the situation of the tubercles in the lungs; in the advanced stages, the greater portion of the agglomerated masses they form may be calcified or cretified by layers, and softened in other parts to form vomicæ of various sizes, containing the detritus already alluded to. These vomicæ, according to Trasbot, appear to be closed, and have no communication with the bronchi or pleural sacs.

In the bronchial lymphatic glands, the tubercles are never absent; they are sometimes seen in those at the entrance to the chest, and more frequently in those of the mesentery and sublumbar region.

In the bronchial glands they in some cases attain enormous dimensions: some measuring a foot in length, and weighing about eight pounds, after having been carefully dissected away from the neighbouring organs. They commence to be formed in the connective tissue surrounding the glands, and, by their growth and multiplication they push these to one side; but the glands are never affected. This peculiarity would appear to establish a marked difference between Tuberculosis in the ox and the human species; as in the latter the deposit takes place in the texture of the lymphatic glands, and in the midst of the normal cells.*

* Trasbot's attempts to establish a difference between Tuberculosis in the human and bovine species place him in direct opposition to Schueppel,

Tubercles are frequently discovered in the liver and spleen; though they are never numerous, nor in large masses, and

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who, in a series of elaborate investigations into the structure and mode of origin of tubercle (*Untersuchungen über Lymphdrüsen-Tuberculose:* Tubingen, 1871), and his investigations on the so-called "pearl-disease" of cattle now under consideration (*Ueber die Identität der Tuberculose mit der Perlsucht;* Virchow's *Archiv.*, page 38 : 1872), has proved the absolute identity of this affection in the two species; thus agreeing with Villemin, Chauveau, and Klebs. According to Schueppel, a tubercle consists of the following elements:—1. Multi-nuclear giant-cells, resembling the myeloplaxes of the myeloid or giant-celled sarcoma; 2. Large cells of an epithelial type; 3. Small round cells, like lymph-corpuscles; 4. A peculiar reticulum, in the meshes of which these cells lie. He also admits that tubercles are absolutely non-vascular; and the giant-cell he regards as their most essential element, as they originate in every case by the formation of such a cell. In a fully-developed tubercle, the number of these giant-cells varies from one to eight or ten. They differ very much in size and shape, are often angular and furnished with branching processes, and may contain from two or three to fifty or sixty nuclei. The bulk of the tubercle is made up of the second element—large nucleated cells of an epithelial type. They are roundish, angular, or fusiform in shape, and their long diameter varies from 0·015 to 0·021 millimètre. They possess a finely granular protoplasm, without any distinct cell-wall, and are furnished with homogeneous vesicular nucleolated nuclei, with a long diameter varying from 0·008 to 0·015 millimètre. Most of the cells contain only one nucleus, but sometimes two or three are present. These cells surround the giant-cells on all sides, and fill the meshes of the tubercle reticulum. The small round cells like lymph-corpuscles, which occur singly or in clusters among the other cells, so far from being the essential element of tubercle, are regarded as not belonging to it at all as such, but as originating in irritation of the intertubercular structures, or of the remains of the tissues in which the tubercles are deposited. As soon as a tubercle has begun to undergo retrograde changes, numerous nuclei, either naked or furnished with scanty remains of protoplasm, become visible. They originate from the disintegration of the giant and epithelioid cells. The peculiar reticulum of tubercle has a considerable resemblance to the reticulum of adenoid tissue; its meshes are generally wider, but are of very irregular size, and sometimes extremely small; its trabeculæ have a finely granular, softer, and more protoplasmic appearance, and are more frequently furnished with nuclei at their nodes, and thus more closely resemble infantile adenoid tissue.

Such is the structure of a tubercle when it has reached its full development. This stage is, however, very short, and in the lymphatic glands

offer nothing worthy of note. In the kidneys and other glands they also appear; and it would seem that the muscles and bones

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does not extend over more than a few days; retrogressive changes then set in. These are:—1. Necrosis, leading to caseation and its consequences—cretification and softening; 2. The transformation of the cellular tubercle into a fibrous tubercle; 3. The formation of concretions and calcareous bodies in the centre of the tubercle (not to be confounded with the cretification of tubercle); 4. Resorption, which is probably always preceded by necrosis.

The formation of concentrically-laminated concretions, closely resembling brain-sand, occasionally occurs in tubercle of the lymphatic glands; they appear to be always attached to the giant-cells. With regard to the seat and mode of origin of tubercle in the lymphatic glands, Schueppel finds that it is invariably situated in the highly vascular *follicles* of the gland, and never occupies the *lymphpaths*, or stands in any connection with the fibrous septa; and he believes that the first giant-cell from which the tubercle is developed is formed in the interior of a blood-vessel, generally a capillary-vein. He thus stands in opposition to those pathologists who, like Virchow, ascribe the formation of tubercle to proliferation of connective-tissue corpuscles, or, like Klebs and Rindfleisch, to the proliferation of the endothelia, especially of the lymphatics and lymph-sheaths of the small arteries.

The first visible step in the formation, according to this authority, is the presence in the interior of blood-vessels, with a calibre of 0·02 to 0·03 millimètre, of peculiar masses of a more or less globular form, made up of a congeries of dark granules, held together by a homogeneous connecting-substance. These masses vary in size, from 0·01 to 0·03 millimètre, contain no nucleus, and have no limiting membrane, but present a granular outline. They may occur singly in the blood-column, or two or three near together. They are most frequently met with in veins, more rarely in capillaries, and very seldom in arteries. These bodies he regards as masses of protoplasm, and proposes to call them non-nucleated protoblasts. The walls of the vessels containing these protoblasts show no change; but where the protoblasts are of large size and block the vessel, it usually presents a fusiform dilatation.

The first change noted in the protoblast is that its outermost layer loses its granular character, and assumes the appearance of a smooth limiting line. This is followed by the appearance of nuclei in its substance, and thus it passes into a giant-cell. Schueppel is inclined to believe that these nuclei arise independently of any pre-existing nuclei; in some giant-cells, however, in addition to the perfectly-formed nuclei, faint homogeneous bodies of smaller size are visible, and these, he thinks, may be an early stage of the former. The nuclei, when once formed, multiply by division, as may be concluded from their often presenting an hour-glass shape, and

are seldom affected. Muscular Tuberculosis is now and again witnessed. The mucous membrane of the intestines and uterus, as well as the udder, are often involved.

We have noticed some of the contingent lesions, which are often confounded with those we have considered as essential. They are generally acute (rare) or chronic Pleurisy; chronic Bronchitis, with cavities formed by the mucuous membrane which has been forced into the connective tissue of the lungs; lobular Pneumonia, with caseous infiltrations, abscesses opening

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containing two nucleoli. The giant-cell now ceases to present its original globular form; it becomes irregular in shape, and puts forth branched protoplasmic processes, these changes being due to its inherent vital contractility. As to what becomes of the vessel in which the protoblast was originally situated, Schueppel can give no account. By the time the nuclei have become developed, the vascular wall ceases to be visible. The epithelioid cells, and also the reticulum—which is not present in the earliest stages of the tubercle—in all probability derive their origin from the original giant-cell. The protoplasmic processes of the latter often present, at a short distance from the parent-cell, fusiform nucleated dilatations, and, by the detachment of these, new cells arise. The reticulum, also, is most probably formed by the processes sent off by the giant-cell; these branch and unite, and surround the first brood of new cells, and so form the meshes in which the other elements of the tubercle lie. The giant-cells appear at last exhausted, as it were, by this constant proliferation, and in older tubercles form shrunken, branched bodies, with few nuclei. The original protoblast, Schueppel considers to arise by free cell-formation—a process, the possibility of which, though long strenuously denied, may be considered to be rendered probable by the researches of recent observers.

In all organs, Schueppel considers the proximate or exciting cause of the formation of primary tubercle to be a local inflammation; while the remote cause is the scrofulous or tuberculous diathesis, inherited or acquired, of the patient.—*The London Medical Record*, Nos. 3 and 4.

Perroncito and Rivolta, in Italy, have also established a complete identity between Tuberculosis in cattle and mankind, and recognized the important part played by the so-called "giant," or, as they designate them, "epithelioid" cells. Gerlach has also certified to the identity of the two diseases.

Semmer, however, denies this identity, and is inclined to think that the two affections are distinct; Tuberculosis in mankind being akin to Glanders in the horse, and not at all like the same malady in cattle. He believes that if infection occurs after inoculation, it is merely the result of Pyæmia, and not the specific disease.

into the pleural cavities or remaining closed; and after the inflammation, induration and gangrenous cavities or sequestra of the lung tissue; with perhaps Enteritis towards the termination of the disease.

The muscles are pale, soft, and flabby-looking, and the blood poor in quality.

DIAGNOSIS.

The symptoms we have enumerated should distinguish this disease from any other affection of the lungs or air-passages in general; but perhaps the best pathognomic signs are the dry and persistent cough, the peculiar respiratory murmur, the pain evinced on pressure behind the shoulder and along the spine, and the quickened respiration while at rest and immediately after exercise. The condition of the external lymphatic glands, the course of the malady, and the evidence afforded by auscultation, are also aids in diagnosis.

CONTAGIUM.

The infectiveness of Tuberculosis, long ago suggested by Morgagni, has quite recently received much attention, and facts of an experimental kind have certainly affirmed its transmissibility by the inoculation and ingestion of tuberculous matter; though it must be acknowledged that, arrayed against the able authorities who have been successful in these experiments, are several who have been unsuccessful, and others who deny that the results obtained have any value in this direction.

Villemin and others have successfully inoculated rabbits, Guinea-pigs, and other animals, with tubercular matter, and produced Tuberculosis; though some experimenters have not succeeded in inducing the malady, and a few have even asserted that the pathological changes brought about by the inoculations with tubercle would have been equally produced had pus been employed.

The contagiousness of Tuberculosis by the digestive organs has been demonstrated experimentally by Villemin, Chau-

veau, Klebs, Gerlach,* and others; but several authorities have likewise denied, from the result of experiments also, that it is so, though they admit that the malady is transmissible by inoculation and in other ways.

Chauveau, of the Lyons Veterinary School, has fed calves and young cattle on tubercular matter, and produced Tuberculosis in them after a certain period.

Harms and Gunther, of the Hanover Veterinary School, have induced the disease in rabbits by feeding them with the flesh and lungs of a tuberculous pig and phthisical cow. They did not find the young of these rabbits infected, though they had been suckled and kept alive for ten weeks.

Leisering, of the Dresden Veterinary School, fed a sheep for three days on the tuberculous lymphatic glands of a cow. After the fifteenth day, the thermometer indicated an increase in the temperature of 1° to 1·5°. On the sixth week, there was cough and emaciation; and towards the tenth week, the respiration was hurried, while auscultation and percussion re-

* Gerlach, of Berlin, in a recent communication to Zundel, of Strasburg, thus details the results of his researches:—1. The Tuberculosis of cattle is very infectious; 2. The tubercules covering the serous membranes, as well as those in the other organs, are as infective, and produce the same tubercles, as the tuberculous matter of the lungs: the identity of the pulmonary Phthisis of cattle and general Tuberculosis cannot be doubted; 3. Infection can be produced after inoculation, as well as after ingestion, of the tubercular matter; 4. The flesh of animals affected with Tuberculosis possesses, in certain circumstances, the power of infecting, though to a less degree than the tubercular matter; 5. The temperature of boiling water destroys the infective principle: though boiled tubercles, nevertheless, often preserve a certain degree of virulence. It is in this as in Trichinosis. Although the temperature of boiling water, or even a lower temperature, destroys the parasites, yet there may be found in the centre of the boiled flesh living trichinæ: muscle being, in general, a bad conductor of heat, and the high temperature only reaching its interior after some time. In some experiments it will be found that tubercles an inch in diameter will, after half an hour's boiling, still possess infective properties, though these are of course diminished.

Gerlach's experiments have been, and are now being, carried on with all kinds of animals, and particularly with cooked and uncooked milk; and he asserts that the infectious properties of this fluid can no longer be denied.

vealed infiltration of the right lung, which had become impermeable to the air. The sheep was killed on the eighty-fifth day, and on examination of its body, the intestinal mucous membrane was found ulcerated, and studded in different places with small tuberculous tumours: the mesenteric glands were tubercular, the liver and lungs were full of tubercles, and in the latter the largest masses were already calcified; the tumified bronchial glands likewise exhibited traces of cretification. Another sheep, which had only received twenty grammes of tubercular matter, also became affected; as did a number of rabbits fed on the same material.

Zürn, of Jena, has fed pigs, first with the milk and then with the flesh of a phthisical cow, and in this way induced different degrees of Tuberculosis in them. Böllinger has produced well-marked Tuberculosis in goats by feeding them with tubercular matter;* and Viseur, of Arras, has been even

* Böllinger made nineteen experiments, the results of which led him to the following conclusions:—1. Tubercular matter obtained from man and inoculated on the dog, produces a typical miliary Tuberculosis of the pleura, lungs, liver, and spleen: inoculations on carnivorous animals in general are negative, or only produce an insignificant local reaction; 2. The inoculation and ingestion of tubercular matter from the ox, produces, in herbivorous animals (goats), tuberculous infection in two forms: miliary tuberculization of the peritoneum, and caseous deposits on the intestinal mucous membrane, as well as in the mesenteric glands; 3. The contents of the bronchi of the tuberculous lungs of an ox produce the same effects as the cheesy matter of the lungs when inoculated or ingested; 4. The ingestion of fresh tubercular matter from the ox has no effect on carnivores; with herbivores, on the contrary, it produces intense tubercular infection, characterized by caseous lesions of the intestinal mucous membrane and mesenteric glands, hypertrophy of Peyer's glands, and the eruption of miliary tubercles on the peritoneum, liver, and lungs; 5. The tubercule poison is active in small doses: twenty to twenty-five grammes of tubercular matter from the lungs, may kill such animals as the goat in two months; 6. The ingestion of pus alone from the caseous lesions does not produce Tuberculosis in the goat; 7. Certain forms of Tuberculosis produced by the ingestion of tubercular matter, present, in an anatomical and pathological point of view, a great analogy to human Scrofula, and, like it, are manifested by caseous degeneration of the glands of the mesentery and neck; 8. There is no incompatibility between Anthrax and tubercular infection.

The experiments of Villemin, Chauveau, Klebs, Gerlach, Bagge, Sem-

more successful with cats; one of these animals, after death, was found to have all the lymphatic glands enormously enlarged; the mesenteric glands were wonderfully increased in size; and the lungs were studded with white, hard tubercles, some of them as large as a barley grain. These cats ate the tu-

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mer, Gunther and Harms, Zürn, Biffi and Vergad, and some personal experiments previously made are put in evidence. According to Böllinger, these experiments may be arranged under four distinct heads :—

I. Ingestion of tubercular matter derived from man. In two pigs and two rabbits, a negative result. In one pig, enlargement of Peyer's patches and mesenteric glands, and cheesy degeneration of parts of these.

II. Ingestion of tubercular matter from the ox: fresh glands, caseous matter, the contents of the bronchi. Animals experimented upon :— Five sheep, two goats, four pigs, eight dogs, a large number of cats, twenty rabbits, one porpoise, eight pigeons. A negative result with the dogs and cats; result nearly always positive with the pigs, sheep, and goats. Most frequently with these animals there was caseous degeneration of the intestinal mucous membrane, mesenteric glands, sometimes the cervical glands, and the lungs. In three sheep there was real "tabies mesenterica." With the rabbits, the ingestion of raw tubercular matter produced results sometimes positive, sometimes negative. In one instance, the ingestion of boiled tuberculous lymphatic glands engendered general Tuberculosis; but on the other hand, boiled tubercles had no injurious effect on five rabbits. And a pig, fed with the same material, only exhibited, after death, tumefaction of the mesenteric glands. Cooked or uncooked tubercles, given to other rabbits, infected them; and the ingestion of tubercles from an ox infected a porpoise, but had no action on two pigeons. The ingestion of caseous pus alone, had no effect on a sheep.

III. Ingestion of flesh from tuberculous oxen, or those artificially infected. Positive result in three pigs: general Tuberculosis or alterations in the lymphatic glands. In one pig, Leucæmia, Scrofula, and Tuberculosis. Result always negative with rabbits when fed with raw or cooked flesh.

IV. Ingestion of the milk of a tuberculous cow. Three pigs, three calves, one sheep, two goats, two cats, and fourteen rabbits. In the three pigs, miliary Tuberculosis, and lesions analogous to those of Scrofula; in the two cats, a negative result; a positive result in two rabbits; a negative result in fourteen rabbits fed with the boiled milk.

Böllinger thinks it possible, or rather probable, that intestinal Tuberculosis, consecutive to pulmonary Phthisis, may be produced by the sputa swallowed and passing into the intestine. He also thinks it demonstrated that Scrofula and Tuberculosis are only two forms of the same disease, at different periods of development.

bercular matter voluntarily. Saint-Cyr, of the Lyons Veterinary School, has also proved the transmissibility of the disease by ingestion ; as has also Bagge, of the Copenhagen School.

Schueppel considers that the tubercle *detritus* possesses infective properties, and is capable of causing the formation of tubercles, both in its neighbourhood and, by absorption, in distant organs.

The question of the contagiousness or virulency of Tuberculosis is, however, still under consideration, and further researches are necessary to elucidate and establish certain important points with respect to it. There appear to be many facts to support the popular notion that the cohabitation of healthy with phthisical cattle will produce the malady in them ; the expectorated matters of the diseased being probably the active agent in this contamination. Viseur, of Arras, gives some facts which may be taken to prove this (*Recueil de Méd. Vétérinaire*, December, 1873) ; and Grad, of Wasselonne, Alsace, quotes evidence which appears to prove, in the most conclusive manner, that not only is the disease communicable by cohabitation of healthy with diseased cattle, but that stalls and stables may become so contaminated by animals suffering from Tuberculosis, that they will infect sound cattle which afterwards inhabit them (*Ibid.* February, 1874, page 94). Cruzel had previously (*Traité de Pathologie Bovine*) drawn attention to this possible mode of transmission.*

VITALITY OF THE VIRUS.

We have not many facts to demonstrate the period during which the tubercle possesses infective power after its removal from the body. Inoculation has demonstrated that the tubercular matter preserves its virulence through three or four removes ; and successful inoculations have been made with tubercular matter from a patient who had been dead for thirty-six hours, and with *sputa* which had been in a dried condition for twenty days. In experiments on animals, it was found to produce no effect after having been boiled, provided the boiling was thorough. Klebs found that the action of alcohol destroyed the virulency of the tubercular matter.

* This evidence will be found in a paper I published on the subject in the *British and Foreign Medico-Chirurgical Review* for October, 1874.

MODE OF ACCESS.

At present we only know that inoculation and feeding by the stomach with tubercular matter will produce the disease in animals. No other modes of access have been tried, so far as I am aware; though several veterinarians have held the opinion that the disease could be induced by healthy animals breathing the expired air of phthisical ones. This pulmonary mode of access has been for a long time considered possible in mankind. Villemin, for instance, is of opinion that transmission of the malady in the human species takes place most frequently by the dry expectorated tubercular matter being accidentally reduced to powder, and carried by the atmosphere into the lungs. Veterinary surgeons have believed that forage, soiled by the expectorations of the diseased and consumed by healthy animals, will communicate the malady.

INCUBATION.

The period of incubation does not appear to be well defined. From ten to twenty days after inoculation, tubercles have been found in the lungs; and the interval may be said to extend from a week to some months, before any very marked symptoms of Tuberculosis appear.

MORTALITY AND LOSS.

We have seen that, in cattle, the disease is invariably fatal at some time or another; but its most serious feature is the considerable period that elapses before this result is reached, and during which the animal becomes gradually less valuable: though it still requires as much, if not more, care, and consumes food all the time. If it is a milch cow, the lacteal secretion is considerably diminished or altogether arrested; and if it is an animal about to be fattened, it more or less hinders that process. In every case, if not allowed to perish from the disease, the animals must be slaughtered to avert utter loss, no matter what their condition may be; so that, economically, the malady is a serious one.

Though very prevalent in this country, we, of course, can form no estimate of its frequency; as there is no regular slaughter-house inspection, nor any measures in force for ascertaining the extent to which a serious malady of this kind

may prevail. In France, as we might suppose, the case is different, and from the reports of the veterinarians in some of the districts, it would appear that there is less Tuberculosis among the cattle of that country than there is in this. For instance, at the Bordeaux abattoir, in eleven thousand cattle only thirteen were found to be diseased. M. Baillet, the veterinary inspector, who, at an early period, recognized the danger of permitting the flesh of tuberculous animals to be consumed as food, reports that after the necessary measures had been adopted, the number of animals so affected, and sent to be slaughtered, rapidly diminished.

SANITARY MEASURES.

PREVENTIVE MEASURES.

The only preventive measures with which we are acquainted, are those of a hygiènic kind: proper food and water; sufficient exercise in the open air; clean, dry, and well-ventilated, but not too cold stables; and keeping the cattle from undue exposure to severe weather. As there is reason to believe that the malady is hereditary, cattle having any tendency to it should not be bred from.

As the experiments which have been conducted by most competent authorities have demonstrated that Tuberculosis can be induced in animals by feeding them with tubercular matter, care must be taken that this is not given to them as food.

SUPPRESSIVE MEASURES.

There being much reason to believe that the disease can be transmitted by cohabitation, whenever cattle show any tendency to it, they should be isolated from the healthy, and every precaution observed with regard to preventing contact. Animals slightly affected should be fattened and slaughtered, and their flesh, if free from traces of the disease, may be utilized. The milk of such animals should be proscribed, and in advanced cases the flesh also.

CURATIVE MEASURES.

Tuberculosis is an incurable disease, but its progress may be ameliorated or retarded by dietary measures. The food should be of an easy assimilable and digestible kind, and

should contain a due proportion of fatty and starchy principles. Linseed, cake and corn, and pea flour, with small doses of linseed oil, are suitable; and the various preparations of iron, as a tonic, and carefully administered, have been found advantageous.

THE FLESH OF TUBERCULOUS ANIMALS AS FOOD.

The question as to whether there is any danger in permitting the flesh of tuberculous cattle to be consumed as food, is of great moment, and has induced me to introduce a notice of the disease, and to describe it, and especially its pathological anatomy, at some length. Until further researches have furnished us with information on several matters connected with this important subject, we can only, with any confidence, offer the following as a summary of what should be the rule at present.

Any organ or texture in which tubercle is deposited, as well as tubercular matter of any description, should not be considered fit for food. As we have no proof that the bones or muscles are usually the seat of tubercle, unless, perhaps, in very advanced cases of the disease,* these may be utilized, if otherwise in a healthy condition.† This relaxation in a sanitary point of view, is almost urgently demanded until we have absolute proof of the noxiousness of such food; as the number of phthisical cattle sent to the slaughter-house is generally very large, and the condemnation of such a quantity of flesh would be a serious economical sacrifice, and one which could not be justified by our present knowledge of the disease. For it must be borne in mind that there are few animals which have been kept for any length of time in cowsheds, and fed and milked in the usual manner, which are not more or less phthisical; more particularly is this the case if the dwellings are bad.

* Van Hertsen gave an instance, occurring in Belgium, of a bull seven years old, and apparently in good health, which, after slaughter, was found to have numerous tuberculous masses in different parts of the body, but especially in the subcutaneous cellular tissue and in the muscles.

† Uncooked blood, however, should not be utilized as an article of diet; its employment as a remedial agent for the human species, demands care in this respect.

Of course, the flesh of cattle in an advanced stage of Phthisis must not be consumed, as, in addition to the risk of its unhealthiness, it is of very inferior quality. Everything must depend upon the extent of the alterations and the gravity of the tubercular lesions. When the tubercles are soft and there are purulent masses, and the alterations are otherwise numerous, danger is to be apprehended from the consumption of the flesh as food. On the contrary, so long as the tumours are hard and dry, and no caseous infiltration has taken place, and especially when the majority of the organs in the abdomen and thorax are not invaded, then the risk is less.

Any danger to be apprehended from the consumption of the flesh of phthisical cattle, may be obviated by thoroughly cooking it.

In view of the inferior quality of the flesh of phthisical animals, those which are suffering from advanced pulmonary or mesenteric Tuberculosis should not be utilized as food for man or valuable animals; though for some of the latter it might be made available after being well cooked; and in the case of cattle affected with this disease, though in tolerable condition, great care should be observed in removing and destroying all the affected tissues or organs.

The flesh of cattle affected with Tuberculosis in an advanced stage presents the usual characters of anæmia. It is moist, or rather watery, pale and bloodless, and the connective tissue is more or less infiltrated with serum; the fat has become a dirty-looking yellowish pulp, also infiltrated with serum; the marrow of the bones is likewise unhealthy-looking and unnaturally soft, and the lymphatic glands not yet tuberculosed are pale and friable. Infiltrations of tuberculous matter may be discovered in various organs and tissues, as before stated.

A careful inspection of the inner aspect of the chest will discover traces of attempts at removal of the tubercles from the costal pleura, and similar traces may be observed elsewhere, especially in the pharyngeal glands and udder; though butchers are usually very expert in dressing such carcasses, so as to elude detection. When the pleura is affected, it is generally removed by the butcher; but even then sometimes one or two small cretified glands will be found in the first intercostal

space, at the attachment of the ribs to the sternum, and others may be unwittingly left below the part of the diaphragm that remains adherent to the fore-quarter. If there is any reason to suppose that pieces of meat have been derived from diseased animals, an examination ought to be made for tubercles in the muscles, which should be freely incised; otherwise its anæmic condition is the only evidence to rely upon, and this cannot be regarded as conclusive.

It must not be forgotten that butchers, in dressing and handling such flesh, incur the risk of inoculation, if the results of the experiments on animals are to be taken into consideration.*

THE MILK OF TUBERCULOUS CATTLE AS FOOD.

That the milk of diseased cows suffering from Tuberculosis is deteriorated in quality, there cannot be a doubt, and we have already noticed in what this deterioration consists; but that its use as food is likely to induce Phthisis, we are only now commencing to obtain proofs.

Klebs has carried out a series of experiments on various animals to test the action of this milk when given as food, and has been successful in inducing Tuberculosis in them. In addition to rabbits and Guinea-pigs—creatures which appear to be extremely susceptible to the artificial production of the disease—he accidentally produced the disease in a dog by giving it the milk from a cow in the last stage of the malady. The results of his experiments led him to the conclusion that the use of this milk always produces Tuberculosis, which first commences as intestinal Catarrh, and then assumes the form of tubercles in the mesenteric glands; it afterwards attacks the liver and spleen, and subsequently the thoracic organs. He asserts that the tuberculous virus exists in the milk of phthisical cows, whether they are slightly or seriously affected, and that it is chiefly in the serum; as when the milk has been so filtered as to deprive it of its solid particles, the fluid portion appeared to be as active as the unfiltered. Its virulency is

* For the same reason, the cultivation of animal vaccine for the purpose of vaccinating our own species, should be carefully conducted. None but young cattle free from the malady should be used; and as a guarantee for the purity of the lymph, it ought not to be employed until they have been killed and examined.

not destroyed by ordinary cooking, and it is all the more active as the disease has reached an advanced stage. He admits that it may produce no injurious effects in vigorous subjects; and he has observed fully developed tubercles to be absorbed and disappear after a time. He thinks it probable that the virus of Tuberculosis may exist in varying proportions in the milk of phthisical cows, according to the extent of the disease in them; and he is further of opinion that the malady may be developed in children born without any tendency to it, through the medium of the milk of the mother or nurse.

Gerlach and others have demonstrated that the milk of tuberculous cattle will produce Phthisis in creatures fed with it.

The commencement of Phthisis is generally so insiduous in the human species, that it is most difficult to arrive with any degree of certainty at the causes which directly produce or favour its development; but from the evidence before us, it is to be feared that at least one of its sources may be referred to this fluid. It is certain that Tuberculosis is a somewhat common and a very destructive disease, among dairy cattle especially, and more particularly those in towns; that the udder is one of the glands not unfrequently involved; that infants and adults consume milk in large quantities—indeed, it is the staple diet of young children; and that Phthisis is a very prevalent and fatal malady in the human species, and chiefly among the dwellers in towns and cities.

There is every reason, then, to prohibit the use of milk from cows affected with Tuberculosis, and especially for infants, who mainly rely upon this fluid for their sustenance, and whose powers of absorption are very active. Even if it did not possess infective properties, its deficiency in nitrogenous elements, and fat and sugar, and the increased proportion of earthy matters, would alone render it an objectionable article of diet. It had long been known that it was liable to produce Diarrhœa and debility in infants; but though these died from general or localized Tuberculosis, the part played by the milk in its production was not suspected.

We have already described the physical characters of this milk.

SCABIES.

SYNONYMS.—Technical: *Scabies* (*scabere*, to scratch). Greek: ψῶρα. English: *Itch*, *Mange*, *Scab*, *Shab*, *Ray*, *Rubbers*. French: *Gale*, *Noir-museau*, *Dartre*. German: *Räude*, *Krätze*, *Schabe*, *Grind*. Italian: *Rogna*, *Scabbia*. Spanish: *Sarna*. Danish: *Skab*. Swedish: *Scabb*.

GEOGRAPHICAL DISTRIBUTION.

THE disease now under consideration probably exists in every quarter of the globe, and affects feral as well as domesticated animals; proving more or less troublesome and destructive among the latter, according to the species and their economical value. This is particularly the case with sheep. Like other maladies of this kind, however, it can be suppressed by sanitary measures. In this way it has been eradicated in New South Wales, Queensland, and South Australia, where its effects were at one time particularly serious, from the immense flocks of sheep maintained in these regions. It is, however, prevalent in Victoria, Tasmania, and New Zealand. It does not appear to be so common among sheep on the American continent as in some other countries.

It was well known to the Greeks and Romans; its contagiousness and destructiveness did not escape the observation of the Latin writers on agriculture, and they appear to have been fairly well acquainted with the best means of preventing and curing it. They gave it (as well as some other cutaneous affections) the technical name it now bears. It was also known to the Hebrews (Leviticus, chap. xxii. ver. 22).

In the Middle Ages it was very common among the flocks, and we find it frequently mentioned in early Anglo-Saxon manuscripts (ꝛceb—*Sceb* or *Sceab*, or ꝛeꝛeꝑ—*tetter*); it is also alluded to by Chaucer and many other writers of a later period; while evidence of its destructiveness is found in the

record of such an epizoöty as that described by Thomas of Walsingham and Stow, and in the Waverly Annals—an outbreak which persisted among the sheep throughout this country for more than twenty-eight years.*

Laws were made in Britain with regard to it so early as the reign of Howel the Good, of Wales (when it was known as *ar clauri* or *clauery*), at the commencement of the eleventh century; and at a later period it frequently received legislative notice in this and other countries.

CHARACTER.

Scabies is a cutaneous, eruptive, and pruriginous disease of the skin common to a large number, if not all, animals, and to mankind, and more or less transmissible from species to species. It is characterized by itching, more or less intense, of the skin; redness; an eruption of small vesicles or pustules; shedding of the hair at these parts; and the presence of considerable uneasiness.

NATURE.

The disease is essentially parasitic, being due to the presence of Acari: minute insects belonging to the order of *Acaridæ*, class *Arachnida*, family *Sarcoptidæ*, which inhabit the skin, some of them excavating their dwellings in it. There are several genera and species of *Acari*, some of which are peculiar to one kind of animals, while others domicile themselves upon several kinds. The *Acari* of mange (*Acarus scabei*) in the different animals may be allotted to three types or genera: these have been named *Sarcoptes* (from σαρκος, *flesh*, and πτησσειν, *to conceal*—the creature which burrows in the flesh); *Psoroptes* (from ψώρα, *the itch*, and πτησσειν, *to conceal*—the creature which conceals itself beneath the crusts of Scabies): also *Dermatodectes* (from δέρμα, *the skin* and δάχειν, *to prick*—the creature which pricks the skin, but does not burrow—the *Dermatocoptes* of Fürstenberg); and *Symbiotes* (from σύν, *with* and βίος, *life*—the creature which lives in families—the *Dermatophages* of Fürstenburg, the *Chorioptes* of Gervais, and the *Sarco-dermatodectes* of Delafond). There is

* *See* Animal Plagues, pp. 79, 80.

also the *Demodex*, or follicular acarus, which is more especially peculiar to the dog.*

In the horse species there are three varieties of Scabies: the "sarcoptic;" the "psoroptic," "dermatodectic," or "dermatocoptic;" and the "symbiotic" or "dermatophagic." In the bovine species there are only two: the "psoroptic" or "dermatodectic," and "symbiotic;" in the sheep three: "psoroptic," "sarcoptic," and "symbiotic;" in the goat two: "sarcoptic" and "symbiotic" (Nubian goat); in the dog one: "sarcoptic," and that due to the peculiar parasite, the *Demodex* or *Acarus folliculorum canis;* in the pig one: "sarcoptic;" in the cat one: "sarcoptic;" in fowls one: "sarcoptic;" in the rabbit one: "sarcoptic."

These varieties of the disease are due to the different acari: so-named subvarieties of these being found to occasion the disorder in particular species.

* The limited space at disposal forbids my attempting to enter upon the natural history of these parasites, extremely interesting though it is. It will be found in the majority of the continental works on veterinary pathology, the French and German veterinarians, particularly the latter, having made an almost exhaustive study of the external and internal parasites of the domesticated animals. The student is specially referred to this subject in Röll's "Manuel de Pathologie et Thérapeutique des Animaux Domestiques" (Belgian edition, vol. i. p. 96); the article "Gale," by Verheyen, in the Nouveau Dict. de Médecine, etc., Vétérinaires" (vol. vii. p. 549); the classical treatise by Gerlach ("*Krätze und Räude*," Berlin, 1857); and the later and most complete monograph by Fürstenberg (*Die Krätzmilben der Menschen und Thiere*," Leipsic, 1861); as well as the writings of Hering ("*Die Krätzmilben der Thiere*," Bonn and Wratislaw, 1838: "*Eine Neue Krätzmilben; Sarcoptes Bovis*." Stuttgard, 1845: "*Ueber die Krätzmilben des Rindes* (*Repertorium*)." Stuttgard, 1845); Hertwig ("*Ueber Krätz und Räudemilben*," Magaz. f. d. gesammten Thierheilkunde, Berlin, 1835: "*Die Räud der Thiere*," Encyclopœdisches Wörterbuch der medizinischen Wissenschaften, Berlin, 1842); Gohier ("*Memoires et Observations sur la Chirurgie et la Médecine Vétérinaires*," 1813); Delafond ("*Recherches sur la Contagion de la Gale*," &c., *Gazette Medicale*, 1851: *Archive Générale de Médecine*, vol. xi.); Mégnin ("*Dermatologie Hippique*," Paris, 1868: *Recueil de Méd. Vétérinaires*, 1872, p. 251); Zürn (*Die Schmarotzer*, Weimar, 1862); and other veterinarians who have made the acari of Scabies in the lower animals their special study.

Ben-Sohr or Avenzoar, an Arab physician who lived in the Middle Ages, first observed the parasite of Scabies.

CAUSES.

The unique determining or exciting cause is the acarus. But certain predisposing causes appear to favour the development and increase of the parasite. In the equine, and no doubt in the other species, all the causes which bring about exhaustion and loss of condition may be looked upon as favourable to the invasion and extension of Scabies; privations, fatigue, absence of cleanliness, insufficient or improper food, and exposure to the weather, are considered as predisposing influences. Hence it is that "mange" in horses is so frequently common and troublesome during campaigns. In the Crimea in 1855 and 1856, the disease was very harassing and destructive; as it was in the Franco-Austrian war, in 1860; and during the invasions of France in 1814, 1815, and 1870-71; and as it was also during the wars of the French Republic.

Reynal, however, points out that though these influences may all be in operation, yet they are neither sufficient to produce the disease, nor to endow it with a fatal character; and he gives the siege of Metz as an instance in which the horses of the French army were placed in the very worst hygiènic conditions imaginable, and yet there was no Mange.

Youth may also, according to the same authority, be considered as predisposing to the malady. Young horses of a soft texture are more readily infected, and remain longer under the influence of the disease, than adult horses. Very fat horses also contract Scabies more readily, sometimes, than those in poorer condition.

These remarks apply more particularly to the "sarcoptic" form of Scabies in the horse. The "psoroptic" form in this animal has also the same exciting and predisposing causes, the former being the psoroptes, and the latter a neglect of hygiène. Indeed, the latter appears so strongly to favour the invasion and maintenance of the malady, that Gerlach asserts that he cured horses suffering from this disease by simply adopting proper hygiènic measures, and giving them good food.

Fat horses with a heavy neck and thick mane, and of a phlegmatic temperament (what the French designate "roux vieux"), are particularly predisposed; the disease is also very persistent in them, and sometimes it is so tenacious as almost to defy treatment. This caused it at one time to be considered as dependent upon a kind of "diathesis," or constitutional vice.

The symbiotic Scabies is also due to an acarus; but the predisposing causes appear to be entirely individual, as the disease is never witnessed in an enzoötic or epizoötic form: privations, neglect of cleanliness, bad food, &c., may certainly be enumerated as aiding in the maintenance and diffusion of the disease; though there are other causes which appear to have more influence. These are youth, a soft temperament, and cold weather, which induces the growth of a fine, short, thick hair, that appears to present peculiar attractions for the symbiot. In addition, during the winter, coarse-bred horses are kept in hot, damp, and only too frequently foul, stables, fed on forage of a poor quality, and seldom cleaned. The disease is consequently most common in winter, and in summer is greatly diminished, if it does not entirely disappear.

The Scabies of the ox is due also to the same influences—acari and inattention to hygiène, and those causes which induce debility. The disease is, therefore, generally most prevalent in the winter; though it is neither an important nor a common malady in countries where cattle are properly attended to. In some regions it frequently prevails as an epizoöty—as in the eastern portions of the Austrian empire, Hungary, the Steppes of Southern Russia, and Norway.

The "scab" of sheep has likewise its exciting and predisposing causes. The cold rains of autumn and winter, bad feeding during these seasons, and confinement in foul, hot, and damp dwellings, favour the maintenance and rapid extension of the disease; while feeding on a good pasture will greatly check it in its spread and gravity. On the other hand, a long loose fleece, but slightly impregnated with perspiration or grease ("yolk"), appears to favour the invasion and location of the acarus, and its rapid propagation. There-

fore it is that short-wooled sheep are less predisposed than long-wooled, and that in those countries where the flocks carry short fleeces—as among the merinos, in America—"scab" is less frequent and less formidable than elsewhere: the animals being more refractory to the contagion, and the disease running its course less rapidly.

As Reynal justly remarks, the Scabies of sheep is enzoötic in all those countries where agriculture is but little advanced, and in which the flocks are badly attended and fed, and depastured in common.

With regard to the other domesticated animals, the same remarks are applicable, so far as the exciting and predisposing causes are concerned; in all, the combination of complex circumstances may facilitate, not the development, but the multiplication of the parasites which produce the disease.

SYMPTOMS OF SCABIES IN THE HORSE SPECIES.

I. *Sarcoptic Scabies.*

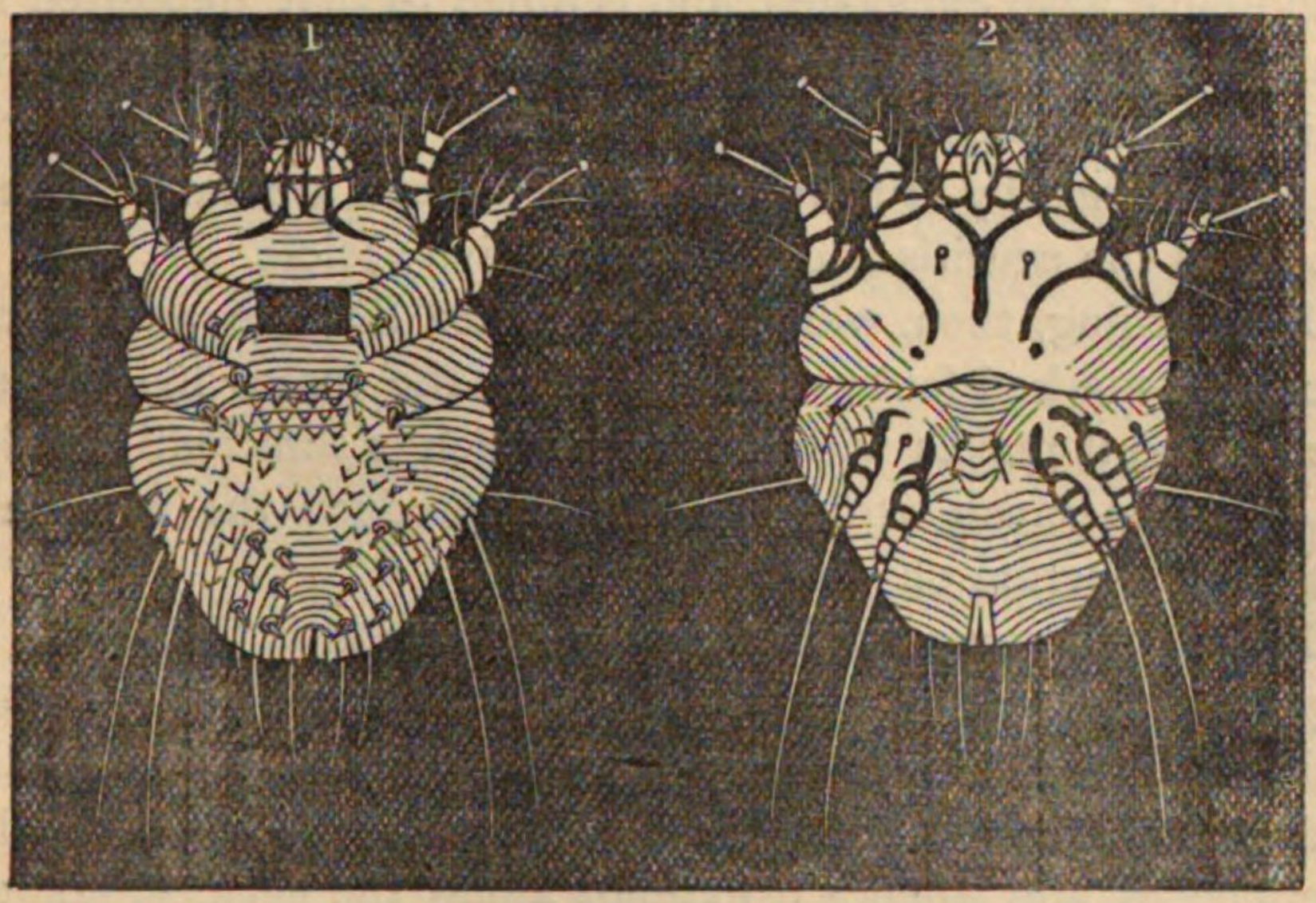
This variety of the disease is not produced by the *Sarcoptes scabiei* of man, as was for a long time believed; but by another parasite, which, if not a new species, is, at any rate, a perfectly distinct variety.* This fact we owe to a distinguished veterinary surgeon in the French army, M. Mégnin, who has made the parasites of Scabies a careful study,† and

* The sarcoptes is the commonest of all the *acari* we at present are acquainted with, being found on the majority of mammals; though perhaps it is not that which is most frequently present in the Scabies of the horse. It infests mankind and monkeys; the carnivora, and particularly the dog, cat, wolf, fox, ferret, lion, hyæna, bear; and herbivora, as the ox, sheep, goat, chamois, camel, llama, and rabbit. It also produces the Scabies of the pig and wild boar, and it has been found on poultry.

† An excellent description of these parasites will be found in Mégnin's paper in the *Rec. de Méd. Vétérinaire* for 1872. I have purposely entered into somewhat of detail on this subject of Scabies, as there is but little reference to it in British veterinary literature: the different varieties being generally unrecognized, and included in the unscientific designation of "mange."

who proposes to name this insect the "*Sarcoptes scabiei uncinatus.*"

The disease is characterized by a symptomatic vesicular eruption, which varies according to the age of the affected animal and its individual predisposition, as well as the stage at which the disease has arrived.



The *Sarcoptes scabiei uncinatus* of the Horse.

Fig. 1. Female: upper surface. Fig. 2. Female: ventral surface.
Fig. 3. Larva of the same. Fig. 4. Male.

The first visible symptom is that occasioned by itching, which is so intense that the horse is incessantly gnawing at the affected parts, scratching them with its hoofs, or rubbing

them against the stall, manger, or any other fixture in the vicinity; and brushing the skin, rubbing it with the fingers even, appears to afford it great pleasure, which is manifested by lying towards the operator, stretching out the neck, everting the upper lip, and flexing the back and hocks. This pruritis increases towards night, and seems to be due to an irritant acrid fluid, or saliva, that the sarcopt throws out in the wound its mandibulæ have excavated, and is allied to that deposited by the gnat or mosquito, or the cantharadine of the Spanish fly. This has been proved by experimentally inoculating with the liquid obtained by crushing the acari; there are immediately produced the pruritis and the consecutive vesicle.

The itching, then, which accompanies Scabies and forms one of its marked features, results from the insect inoculating the wound it makes with a poison, which is sufficiently active to cause as much irritation as will produce the necessary quantity of serum on which it lives.

The second symptom in order of succession is the vesicle or papule. In passing the hand over the parts of the body which the horses seek to rub, and especially on each side and at the base of the withers—where the disease generally commences, and whence it extends along the neck, shoulders, and back, until all the surface of the body is invaded, except perhaps those covered by long hair, as the root of the mane and tail—in passing the hand over these parts, a multitude of small hard pimples are found, which feel to the touch as if small seeds had been sown at the root of the hairs, and had adhered to the skin. Examining one of these points closely, there is discovered a very little scab, to which adhere two or three hairs; this crust is readily removed with the nail, and leaves a round, denuded, red, and humid surface, about the eighth to the fifth of an inch in diameter. When the crust is detached, there is no longer a prominence, except in rare cases. This is the "vesicle" of Scabies, and it contains a minute quantity of acrid and irritating serum of a yellow colour; it rarely assumes the papulo-vesicular character so common in man; and at a later period, when the vesicles have become confluent in consequence of their great number, the

result is a veritable Ekzema, as Mégnin has remarked. This is very noticeable, in white horses, on the back and loins.

The sarcoptic Scabies of the horse is, then, essentially ekzematous, and may readily, at a first glance, be, and has frequently been, mistaken for non-parasitic Ekzema.

At a more advanced period, large surfaces of the body are destitute of hair, the bare patches being very irregular in outline; on these are observed excoriations more or less extensive, and crusts of variable thickness, formed by the epidermic scales and the concretion of the serum thrown out on the surface, either as a consequence of the irritating attacks of the sarcoptes, or more probably from the rubbing and incessant gnawing of the horse. The crusts in sarcoptic Scabies are dry, powdery, and furfuraceous.

To this simple Ekzema succeeds a sort of "lichen," which, according to some authorities, is only the third phase of Ekzema. The skin becomes infiltrated, thickened, wrinkled (especially at the neck), fissures (which may suppurate) appear in it, and it assumes a kind of resemblance to that of the rhinoceros. This constitutes the chronic or inveterate stage of Scabies, and it may, Mégnin asserts, persist for a long time after all traces of the parasite have disappeared—become, in fact, constitutional when the temperament or a diathesis, such as herpetism, are allied with it. The disease might then be designated chronic Lichen, and it demands a different treatment.

The third symptom—the most important, and which may justly be looked upon as pathognomonic of the disease, for without it the diagnosis can never be really certain—is the presence of the parasite itself. The discovery and determination of the sarcopt requires a certain amount of knowledge of its habits and conformation, as well as tact in manipulation, and ability to use the microscope—accomplishments which are not always to be found among those who have to deal with diseased animals. The mode of seeking for the parasite is given below ;* and we have only now to state that it appears

* It is well to know, when attempting to discover the existence of the *sarcoptes scabiei uncinatus*, that, unlike the other parasites belonging to this family, it does not live in colonies, but leads an isolated existence; its

to be generally acknowledged that there is no proof that the sarcopt of the horse makes a furrow in the epidermis, as no trace of it has been discovered. This, however, may be owing to the

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haunts not being in the most superficial crusts, like theirs, but much deeper. It is not improbable that it excavates trenches, or sub-epidermic burrows; though these have not been distinguished in animals, owing to the thick skin, hairs, and the other causes above noticed, which also render a search for the parasite more difficult and less successful than in man, in whose skin the furrow can easily be seen. The creature also appears to be of a sensitive nature, for in cold weather it cannot be found. So when it is desired to ascertain the presence of the sarcopt, a calm day and a warm sun must be waited for; and to the latter the horse must be exposed for an hour before the necessary steps are begun. These consist in collecting the crusts and furfuraceous dust of the diseased parts, which may contain some of the larval sarcoptes; but to obtain the adults, it is absolutely necessary to go deeper, and, with a sharp instrument, to scrape off the epidermis, even to the dermis.

It must be remarked that the disease usually commences at the withers, neck, head, and shoulders, which are the parts that generally infect other horses: spreading to the back, sides of the body, and finally the legs, which lose their hair like the other regions. It must also be noted that all the horses which are affected with Scabies do not harbour an equal number of sarcoptes; on the contrary, it is frequently those which appear to be most affected, and which have the most numerous and thickest crusts, that furnish fewest parasites; while the horses whose skin has the driest and thinnest scabs yield the largest number. In well-bred, fine-skinned horses, more are found than with those which are coarse and fat, and which have a thick cuticle. Recent cases, which have not been submitted to any curative treatment, should also be selected; as when the disease becomes chronic, the Scabies often disappears, and gives place to a chronic Ekzema or Lichen, which is not parasitic.

Having obtained a sufficiency of crusts and epidermic scales, these should be put in a warm place, or exposed to the rays of the sun, to rouse the sarcoptes from their inertness; otherwise they cannot be distinguished from the dried globules of serosity among which they lie. When this has been done, a small quantity of the dust is spread on the glass slide, and carefully examined: at first under a power of forty or fifty diameters, by means of direct illumination, the dark background being most suitable.

The warmth causes the parasites to detach themselves from the mass of *débris*, and they may then be removed on the point of a needle to another slide, on which is a drop of glycerine. After this has received a covering-glass, they may be fully and leisurely examined by means of the powers

furrow not being visible, either because of the thickness of the skin, the perpetual gnawing and rubbing it undergoes, or to the pigment which is present in the integrement of nearly every horse.

COURSE AND TERMINATIONS OF SARCOPTIC SCABIES IN THE HORSE.

Sarcoptic Scabies is slow in its progress at first, but it spreads with an astonishing rapidity at a certain period of its evolution; and, under favourable circumstances, in less than a week it will have invaded the whole surface of the body, its extension being in a direct ratio with the multiplication of the parasites. This need not be wondered at, when it is remembered that a female sarcopt has been calculated to bring forth in the course of its existence thirty other females, besides the males, which do not appear to be so numerous; these, in about a month, can reproduce, and so multiplication goes on.

The natural duration of the disease is not certain, as curative treatment is generally adopted. In the Crimea, where I had many hundreds of horses suffering more or less from this variety of Scabies, and among which there was a great mortality, there could be no doubt whatever that this, added to the other hardships, soon produced a very marked and most unfavourable derangement in health; the loss of condition being rapid—marasmus ensuing sometimes within a month; while the skin, gathered into deep vertical wrinkles about the

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best adapted to display their general conformation (two or three hundred diameters), and the details of their organization (four to five hundred diameters). (*See* figures of this parasite on page 403.)

In making these examinations, it is necessary to remember that in the epidermic detritus of all horses—no matter whether the skin is healthy or diseased—there are found the bodies of acari derived from the dust of forage—such as *Glyciphagæ*, *Cheyletæ*, *Tyroglyphæ*, &c., which might be mistaken for the sarcopt, though they are perfectly harmless. And the larvæ of the *Gamasidæ*, which may live in great numbers as parasites on the horse and other of the domesticated animals, might still more readily be mistaken for it, as they are alive. They, however, cause no injury, but merely live on the surface of the skin among the hair, like the *Sarcoptides avicola*.

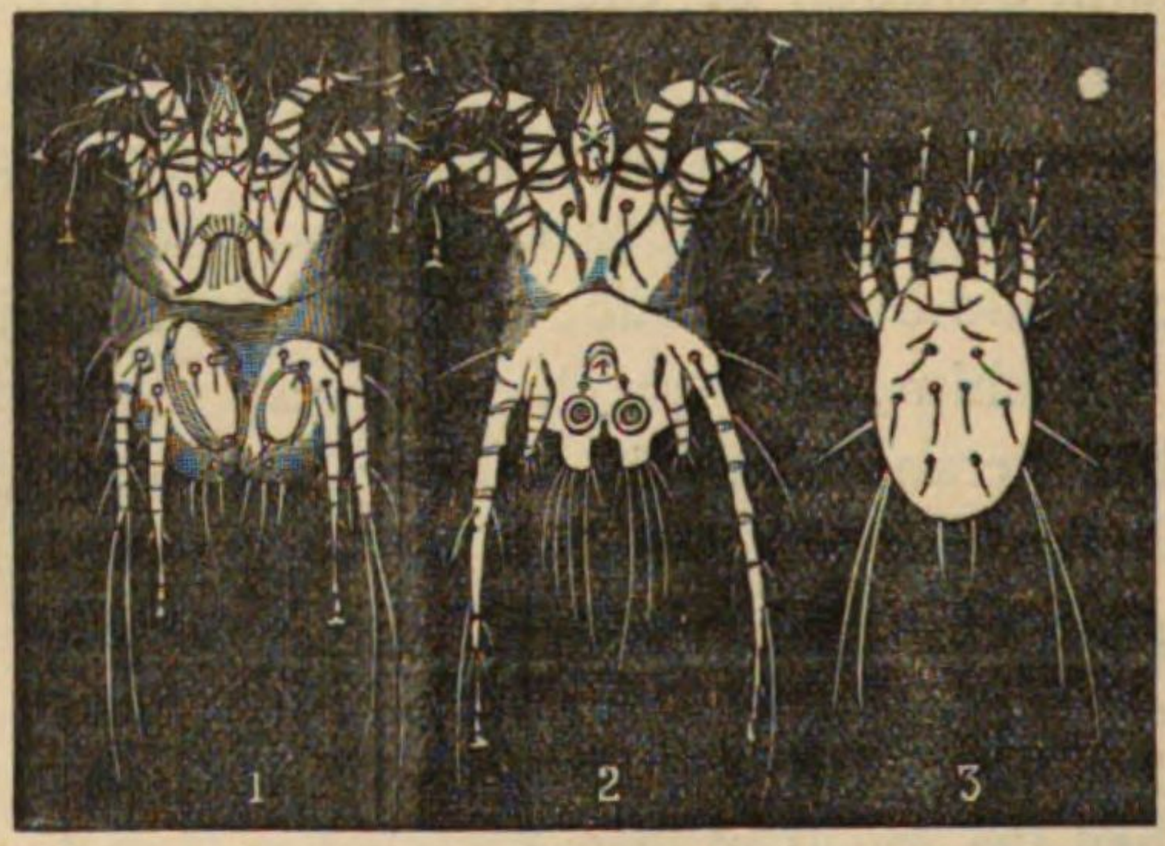
neck and shoulders, destitute of hair, hot and scaly, and bleeding in places, barely concealed the bony framework; the animals died, within a variable period, from exhaustion.

It is not a matter for doubt that horses when stabled, and well, or even moderately, fed, will resist the irritation without exhibiting much disturbance in health; but it is quite otherwise when they are exposed to hardships.

It has been remarked that after the disease has been cured, the hair on the affected parts grows very rapidly and longer than elsewhere; and also that it is darker coloured, as if the poison of the sarcoptes had exercised a specific influence on the hair bulbs.

2. *Psoroptic* (Gervais and Mégnin), *Dermatodectic* (Gerlach and Delafond), or *Dermatocoptic* (Fürstenberg) *Scabies.*

This is the common variety of Scabies—Psora (known to the French as "gale humid," "roux vieux")—and has been



The *Psoroptes* or *Dermatodectes* of the Horse.
Fig. 1. Female. Fig. 2. Male. Fig. 3. Larval hexapod.

longest known. Indeed, in this country, I am not aware that any other variety of Mange is usually recognized. It is characterized by intense itching, and a papulo-pustular eruption, which is soon transformed into Psoriasis. Several varieties of the *Dermatodectes* or *Psoroptes* infest the domesticated animals; this of the horse lives in numerous colonies, which extend in radii, and give to the psoroptic or dermatodectic Scabies its

peculiar and characteristic aspect—large patches of Psoriasis separated from the healthy surface by a well-marked boundary. The parasites are more particularly located about the neck, and especially towards the root of the mane. The irritation they excite is more harassing and severe than that induced by the sarcoptes.*

They are somewhat rare in the mule and ass.

The initial form of the lesion produced by the psoroptes is a papula, as that of the sarcoptes is a vesicle. This papula is a little hemispherical eminence on the skin, about one-third of an inch in diameter and one-eighth of an inch in height, which soon becomes a papulo-vesicle by the formation at its summit of a vesicle that is quickly ruptured, and, its serous contents escaping, gives rise to a crust when these become dry. The papula, however, continues to discharge, the crust increases,

* The psoroptes is much more easily collected than the sarcoptes. It is sufficient to gather the humid crusts from the diseased surface, and especially from its margin, to obtain specimens of all ages and both sexes, as many males as females being found, which is not the case with the sarcoptes: the long time required for coupling in the former, and which continues for several days, probably necessitating this equality in number of the sex; while in the latter it is brief, so that one male suffices for a considerable number of females—10 to 100, according to Mégnin. To examine the crusts and isolate the parasites, the same procedure is adopted as for the sarcoptes; and owing to their larger size and greater numbers, they are more promptly discovered than that mite. They may even be seen with the naked eye on the horse, burrowing among the crusts, and they can be collected there by means of a needle.

The psoroptes, like all the psoric acaridæ, lives on serosity. Its mandibulæ are long, and so peculiarly formed that they can cut through the epidermis, and thus cause an effusion of serum, which it absorbs. The inflammation resulting from these punctures, and the irritant properties of their saliva, cause an exudation, and consequent thickening of the epidermis, which defies the further action of the mandibles. This is why the psoroptes always seeks parts yet healthy, and thus produces a gradual extension of the malady; it also explains why it is found in largest numbers on the boundary of the diseased part.

Gerlach and Delafond, having experimented on their own persons with the different psoric acari, state that the bite of the psoroptes is more painful than that of the sarcoptes; and this can readily be credited if their aggressive organs be compared.

and there is a mixture of these and the humid epidermic detritus, that gives it an appearance very different to the sarcoptic crust, which is always very dry and furfuraceous.

The papulæ do not remain isolated for a long period; the colonies of parasites increase, and, keeping together, the papulæ likewise multiply in the same part, until they become confluent, and give rise to real patches of Psoriasis. Psoriasis, therefore, characterizes psoroptic Scabies, as Ekzema characterizes sarcoptic Scabies.

The psoric exanthem is entirely local, and is produced by the acrid secretion of the parasite, which is in every respect more powerful than that of the sarcopt. The multiplication of the parasites also multiplies the partial inoculations, and the eruption extends, while the papulæ become more numerous, and more closely grouped; the derma becomes inflamed, and exudes; the epidermis desquamates; the exuded matter glues the hairs and the scales together, and dries, and these organic *debris* form crusts, which serve as an asylum to the acarian population.

The greater acridity of the secretion of the psoroptes, and its longer mandibles, accounts for the more serious alterations in the skin observed in psoroptic than in sarcoptic Scabies; in the former, not only are the ordinary hair-roots involved, but also those of the mane—a feature not observed in the other variety.

The regions more particularly affected are those where the parasite is least likely to be disturbed by grooming or rubbing; these are the upper border of the neck, the forelock, and the root of the tail. At these parts the skin is covered with papulæ, tumefied, thickened, and wrinkled; crusts form, which agglutinate the hair, and, being shed, carry these with them, as well as the hair of the mane and tail: which removal is further expedited by the energetic rubbing induced by the violent pruritis. From these parts the disease slowly extends as the acari multiply: involving the withers, backs, loins, sides of the body and neck, shoulders, chest, croup, belly, face, inner side of the limbs, and between the branches of the lower jaw.

When psoroptic Scabies has invaded the body to any ex-

tent, it no longer preserves its simple character ; as the severe and continuous rubbing and biting to which the skin is subjected produces excoriations, wounds, and contusions, and causes an abundant exudation which hinders the normal function of this organ ; abscesses and fistulæ, in the region of the occiput and withers, are not unfrequent results of these injuries.

The last and conclusive symptom, in so far as the diagnosis of the disease is concerned, is, as in sarcoptic Scabies, the presence of the parasite.

COURSE AND TERMINATIONS OF PSOROPTIC SCABIES IN THE HORSE.

This variety of Scabies is less serious than the one just described ; as it is less contagious, does not extend so rapidly, and is not so ready to assume a wide-spread or epizoötic character, rarely affecting a large number of animals at once; it is also more easily cured and diagnosed.

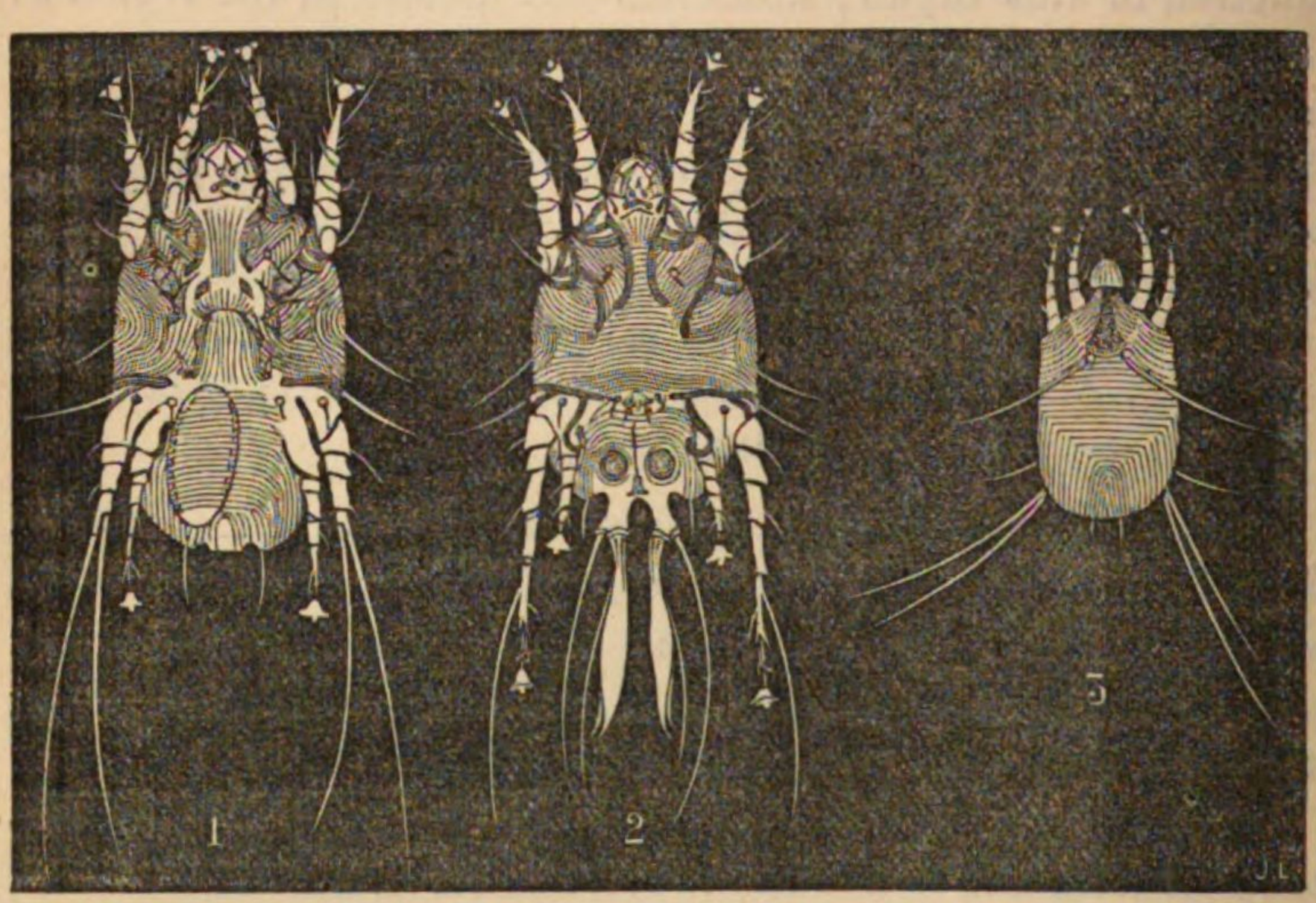
But if, nevertheless, the disease is not medically or hygièni-cally treated, and is allowed to run its course, it will determine, in a variable space of time, and from the constant annoyance, as well as disturbance in the functions of the skin it occasions, a cachectic condition from which the animal may succumb.

3.—*Symbiotic or Dermatophagic Scabies.**

This variety of Scabies is due to the *Symbiotes* or *Dermatophagus*, a parasite which lives in numerous troops or societies on the limbs of horses, and do not burrow like the sarcoptes :

* Gerlach created the genera *Symbiotes* for an acarus which had been previously studied by Hering, and named by him *Sarcoptes bovis*. In doing so, Gerlach was quite justified ; as this parasite is different in several respects from the sarcoptes and psoroptes. At a later period Delafond discovered it on the goat, and, unaware of Gerlach's researches, first named it the *Sarcoptes capreæ*, and afterwards the *Sarco-dermatodectes*. Gervais instituted the genera *Chorioptes* on its behalf, and Fürstenberg increased the confusion by designating it the *Dermatophagus*. Robin has, however, restored to it the name by which Gerlach made it known, and this it is best to retain. It may be as well to mention that Mégnin discovered a symbiot infesting a horse in Lorraine, which appears to differ

only irritating the skin by their bites, and in this way causing the production of crusts, among which they nestle like the psoroptes. They differ from the latter, however, in being much more stationary: being apparently loath to leave the region they



The *Symbiotes spathiferus.—Mégnin.*
Fig. 1. Female. Fig. 2. Male. Fig. 3. Larval hexapod.

may have invaded, until their numbers at length compel them to extend ; and thus they increase the diseased surface, though even this occurs slowly. Fürstenberg has stated that they

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from that described by Gerlach as peculiar to the horse, and also from the symbiot figured by Fürstenberg. The taxinomic points of difference chiefly consist in the presence, on the abdominal lobes of the male, of hairs which remarkably widen out in the form of a spathe ; whereas the symbiot of the other observers has only single round hairs like the female acarus. Robin is of opinion that this is a new species, and Mégnin has accordingly named it the *Symbiotes spathiferus*. It may, however, be the same parasite studied by Gerlach, who probably overlooked this peculiar feature in its conformation ; or his engraver may have altered it, as the illustrations in his excellent treatise are not faultless in this respect. The Symbiotes is found among the crusts in a similar manner to the Psoroptes.

It may also be mentioned that Gerlach and Gurlt have discovered this parasite on the elephant. It has likewise been found on a number of birds —the finch, crow, linnet, sparrow, partridge, &c.

live exclusively on the young and soft epidermic scales, and Röll repeats his statement; but Mégnin points out, with some force, that their mandibles serve to tear away the epidermis and expose the derma, and this, together perhaps with an irritant matter they may secrete, causes a serous exudation upon which they subsist: as the contents of their stomach is manifestly composed of globules of yellow serosity, and not of chyme resulting from the trituration of the epidermic cells, as Fürstenberg believed, and which induced him to give the designation of *Dermatophagists* to this group. The excess of the serum concretes, and with the *débris* of the epidermis forms numerous crusts that break in large flakes, and which is one of the characteristics of symbiotic Scabies. The local lesion is the first symptom that attracts attention; for the itching, although it exists, is not nearly so marked as in the other two varieties. The commencement of the disease is rarely noted, but from the slight tumefaction of the affected skin and the character of the crusts covering it, it has been conjectured that the initial eruption consists of a vesico-papule, which, becoming confluent by multiplication, gives rise to the diseased surface. This resembles, like that of psoroptic Scabies, veritable Psoriasis, except that it is less humid: being conspicuous for its dry and mealy appearance. There is not observed the isolated eruption around the margin of the disease as in psoroptic Scabies; for the symbiot does not seek a healthy surface like the psoropt, but lives entirely on that which it has covered with crusts, and only extends its dominions when the parasites have become too numerous.

As has been mentioned, when alluding to the predisposing causes of Scabies, this form is almost peculiar to coarse-bred lymphatic horses: especially the heavier draught kinds, whose limbs are covered with shaggy thick hair. The disease most frequently commences at the fetlocks, and slowly extends towards the body, though seldom rising above the knees and hocks; if it chances to appear on the lower surface of the abdomen, it is because the animal, in lying, flexes the limbs against that region, and the contact at last brings about an immigration of the parasites.

An abundant desquamation takes place; crusts form, and the hair falls off; the subcutaneous connective tissue becomes infiltrated and indurated; the skin is gradually hypertrophied, and may become fissured in the pastern and along the tendons: the fissures containing a quantity of bloody serum, and a large number of acari. When the malady has persisted for a very long time, and become inveterate, the skin is still more altered, being studded with papilliform prolongations surrounded by deep fissures, and covered by a more or less friable horny layer—each of the vegetations corresponding to a hypertrophied papilla. The itching accompanying these alterations is not so great as in the two other varieties, and is chiefly manifested at night or during rest; or when, in the process of shoeing, the limb rests on the knees of the farrier. The animal rubs the affected leg against the opposite one, or against any object with which it may come into contact; it paws, stamps, and sometimes gives a kick, or at intervals gnaws the pruriginous surface with its teeth; but the lesions produced in this way are always insignificant.

COURSE AND TERMINATIONS OF SYMBIOTIC SCABIES.

This is the least serious variety of Scabies affecting the equine species, as, from the situation and habits of the parasite, the disease is seldom conveyed to other horses; and though one hind or fore-limb does frequently affect its fellow on the opposite side of the body, yet it is more rare for a hind to affect a fore-leg, or *vice versâ*.

The disease may continue for years without extending above the knees or hocks. Mégnin saw a case in which it took three years to travel from the fetlock to the stifle.

The malady appareently disappears spontaneously in summer, but returns with the advent of winter more severely than before. Nothing is known for certain as to the cause of this; though it has been surmised that the ova may require this period of incubation, or that all die except some females, in consequence of the more abundant secretions of the skin during the summer season.

DIAGNOSIS OF THE DIFFERENT VARIETIES OF SCABIES IN THE HORSE.

Though the enumeration of the symptoms of the different forms of Scabies in the horse might very well serve as a guide in distinguishing them from each other, and from any disease which affects the skin of this animal; yet it may be well to recapitulate what has been stated in this respect, and to note the differences between them and other cutaneous maladies.

Sarcoptic Scabies may be mistaken for several dermatoses. At its commencement, it bears a great resemblance to the Pityriasis caused by the *Hæmatopinus:* particularly as in this there is also pruritis, and the two maladies are not unfrequently concomitant, especially among army horses during war. Mégnin mentions that at least one-fourth of his cases of Scabies during the late campaign in France, were complicated by the *Hæmatopinus;* but then this is a visible parasite, and its effects are always readily distinguishable from those of the sarcoptes, by the ekzematous eruption that quickly ensues with the latter. But this Ekzema, again, bears a perfect resemblance to that which is sometimes observed in young horses, particularly when they are affected with "strangles," and more especially if the ekzema is of a herpetic nature. In the first-named Ekzema there is no pruritis, and the eruption rapidly and spontaneously disappears; but in the herpetic form there is itching, the malady is somewhat persistent, and there is the same tendency to the lichenoid degeneration noticed in the eruption of sarcoptic Scabies; so that, if there were no observations as to contagion, nor as to the rapid extension of the disease, and if the microscope were not resorted to by competent hands, the affection might readily be mistaken. The effects of treatment, however; the progressive course and peculiar symptoms of sarcoptic Scabies; and the transmission of the disease to other horses or to mankind ;*

* Without resorting to the microscope, the presence of the parasite may in this disease be readily demonstrated by fixing a quantity of the *detritus* and crusts on the skin of the arm, by means of a bandage. If the sarcoptes is present, a number of white points, each in the centre of a red papule, will appear in about twelve hours. These contain the acarus, which may be removed by the point of a needle.

should serve to differentiate the latter from other diseases. And the discovery of the parasite will, of course, make the diagnosis certain.

What has been designated "constitutional prurigo," might also be mistaken for sarcoptic Scabies; but the crusts, and their form and aspect, furnish the chief diagnostic indications. In the first-named disease, the papular efflorescence, excoriated by rubbing, is soon covered by crusts; but these are small, thin, and discrete, reddish-brown in colour, and limited to the papulæ. Between these crusts and those of Scabies, which are longer in being formed, the difference is too characteristic to leave any doubt as to the character of the malady. The natural or artificial transmission of the disease to animals of the same species, or to man, and the discovery of the sarcoptes, should be conclusive, if other evidence is wanting.

Sarcoptic differs from psoroptic Scabies in the rapidity with which it spreads over the body, and its great contagiousness; the presence of a vesicle in the early stage, and not a papulo-vesicle, as in the latter disease; the Ekzema, so different to the psoriasis of Psora; the character of the difference in the crusts in the two diseases; their different situation; and the marked demarcation between the healthy and diseased surfaces in psoroptic Scabies, as well as the moderate progress of the latter. The presence and size of the parasite, which can be discerned by the naked eye in psoroptic Scabies, is also decisive evidence.*

Psoroptic and symbiotic Scabies, perhaps, most resemble each other; they have the same aspect, same form, and the crusts are not very dissimilar: though they are drier in the latter variety. But the location of the two affections is very different, as has been noticed—the one being situated on the limbs, and the other on the upper surface of the body. The pruritis, too, is intense in psoroptic Scabies, but very slightly so in the symbiotic form: which is also more particularly a winter disease, while the other appears in all seasons.

* As in sarcoptic Scabies, the presence of the animalcule can be proved at an early period, by applying the crusts against the skin of the arm. In a few hours the parasites commence to bite.

The presence of the parasites in the three varieties of Scabies always affords an indisputable proof of the nature of the malady.

CONTAGIUM.

The contagium of Scabies is the cutaneous parasite. The three varieties of Scabies differ widely in their degree of contagiousness. Sarcoptic Scabies is intensely contagious, and spreads rapidly from one horse to another; so that in a short time a large establishment, a regiment of cavalry, a brigade—even all the horses of an immense army—may, if circumstances are favourable, become infected by the introduction of one or two diseased ones among them, and the malady will assume quite an epizoötic form.* This exaggeration in the contagiousness of sarcoptic Scabies appears to be due not only to the fact that the female parasites preponderate very largely, but also that the mites are not sociable in their habits, and seek to wander in the most erratic manner, and thus continually diffuse themselves; as well as to bury themselves in the epidermis, whence brushing, biting, or scratching cannot remove them.

The facility with which transmission takes place is related to the duration and intensity of the disease. At an early stage, cohabitation with an infected horse is not nearly so dangerous as when scales and crusts have formed; as the parasite then readily passes from one animal to another, and the slightest contact may suffice for its transmission.

The other two forms of Scabies are much less contagious, from the different habits and organization of the parasites. The Symbiotic variety is very slightly contagious.

There can be no doubt whatever, that the sarcoptic Scabies of the horse is transmissible to the human species: though less readily so than in the equine race, or than the ordinary Scabies of man is transferable to other men; neither does the parasite appear to thrive continuously in its new abode. It is the same with the itch insect of man when carried to the skin of the horse.

* Several epizoöties of Scabies in the equine species will be found mentioned in "Animal Plagues."

Many well-substantiated observations are on record of persons receiving the disease from infected horses. In the Crimea I saw a large number of Turks suffering severely from Scabies, due to their sleeping on the saddles and blankets worn by their horses, whose skins were covered with "mange." Mégnin has also observed this accident during the late Franco-German war. During the last century, this transmission was not unfrequently observed. Sick, for instance, mentions that, in 1791, epizoötic Scabies appeared in a regiment of Hussars, and more than 200 soldiers became infected. And Longchamps informs us that in 1794, the horses and mules of the French army in the South of France were affected with the "gale" to a very serious extent, and that the disease was transmitted to, and propagated among, the soldiers.

The *Sarcoptes* can also be transmitted to the bovine species, if the clinical observations of Sick and Greve are considered; though, according to Gerlach, it does not appear to develop on dogs, cats, or pigs.

The *Psoroptes* is not transmissible to other animals: experiments with cattle, sheep, pigs, dogs, and cats, having always been negative in their results.

When transferred to the skin of man, it excites a very violent pruritus, but does not produce an eruption, and soon perishes.

The *Symbiotes* of the horse is likewise not transferable to mankind, nor to the other domesticated animals; if anything at all, it only produces a mild transitory itching in them.

The three parasites, and consequently the three varieties of Scabies, may be present on the same horse.

VITALITY OF THE PARASITES.

With regard to the vitality of the acari of Scabies, when removed from the bodies of the animals they infest, it may be remarked that the *Sarcoptes* perishes in five or six days; though in a damp atmosphere or medium—as manure—it may exist from ten to fourteen days. The *Psoroptes* and *Symbiotes* are more tenacious of life, though they generally perish within three or four weeks; it must be noted, however, that sometimes, after being apparently dead, they have been restored

by warmth and moisture within a period of six or eight weeks. They soon die when kept in a dry atmosphere; when dried; or when exposed to a high temperature—100° to 120° Fahr. Cold is also fatal to them.*

MODE OF INFECTION.

As has been already remarked, the contagiousness of the three varieties is not at all equal, the Sarcoptic being the most readily and rapidly transmitted from one horse to another; the Psoroptic being much less so, and the Symbiotic the least of all.

Infection takes place through transference of the parasites, either directly or indirectly, from the skin of a diseased to that of a healthy animal. The immediate association of diseased and healthy animals, or the contact of harness, clothing, grooming utensils, litter, the wood-work of stalls, or even of men who may have been handling the former, are the usual modes of infection.

Symbiotic Scabies is not very contagious, and transmission

* Gerlach found that a dry heat of 144° destroyed the sarcoptes within an hour; and kept in a watch glass it perished in five or six days, though when removed with the crusts it might survive until the eighth or tenth day. In an inhabited stable, it lived to the twelfth and fourteenth day. On a fragment of skin, covered with crusts and exposed to heat, the parasite died, after dessication of the skin, about the ninth day; but if the latter preserved its humidity, the sarcoptes exhibited faint indications of life, though it was quite dead on the twenty-eighth day.

The vital resistance of the psoroptes was found to surpass that of the sarcoptes; as when removed from the animal and kept in a dry atmosphere, it lived from ten to fourteen days, and from twenty to thirty days in a stable. Though apparently dead, nevertheless, by means of heat and moisture, it was revived at the end of six and eight weeks, but it never rallied sufficiently to be able to penetrate the skin. The resistance of the male was found to be greater than that of the female, unless the latter happened to be pregnant.

The symbiotes was the most resisting of the three. Kept among crusts in a warm room, it became apparently dead in about ten to twelve days, but heat and humidity rallied it after fourteen days. In a warm room during the spring, it did not succumb until the fortieth day, and in a stable not until the fiftieth day.

is most likely to take place through the medium of hot damp litter, in which the parasite may live for several months.

INCUBATION.

The period of incubation for the three varieties has not been very accurately determined; but for the Sarcoptic, it is probably between fourteen and sixteen days before any marked symptoms are discernible, after the parasite has been transferred to the skin of a healthy horse.

It is not unlikely that the other varieties may have about the same interval.*

EXTENSION.

Extension takes place in the manner stated in the paragraph relating to the mode of infection. But it must be remarked that inattention to hygiène, exposure to fatigue and privations of every kind, and particularly to tempestuous weather, greatly favour the extension of the disease. Hence, it is nearly always one of the most formidable and troublesome

* The fecundity of the parasites, of course, influences greatly the duration of the incubatory period; but as this is somewhat astounding, we can scarcely wonder that, in the case of sarcoptic Scabies at least, the malady should extend so rapidly.

The female of the sarcoptes deposits its eggs in a furrow of the skin, and after they are hatched the envelopes remain, and thus indicate the number of young each can produce. Gudden has counted fifty-one of these envelopes; but this has been considered an extraordinary instance, and a more moderate estimate of twenty-two to twenty-four has been made for each brood. The psoroptes and symbiotes, depositing their ova on the skin, cannot so readily be made amenable to observation in this respect; though, judging from analogy, their reproductive powers must be equal to those of the sarcoptes. The females, being more numerous than the males, polygamy is the rule. When seven days old, the acari are ready for procreation, and probably about the twenty-third day a second generation appears. Gerlach, taking as a base the number of ova found in a sarcoptic furrow, estimates the product of each female as fifteen, of which five are males and ten females; and allowing the procreative faculties to be in operation when these are fifteen days old, he gives an increase which has certainly no pretensions to mathematical exactitude, but which may nevertheless afford some idea of the rapidity with which these parasites breed and spread among animals.

maladies—in the Sarcoptic form—which the army veterinary surgeon has to contend with during a campaign; and for the same reasons it is always more or less prevalent in badly managed stables, especially those of the lowest class of horse-owners.* The winter season is most favourable for the extension of sarcoptic and psoroptic Scabies, probably owing to the thicker coat which horses then carry; and it is at this time, and for the same reason, that it is most difficult to suppress.

The extension of Scabies is slow, and often interrupted, where horses are properly fed, sheltered, and cleaned.

MORTALITY AND LOSS.

The mortality from the two most serious varieties of Scabies greatly depends upon collateral circumstances. We have already shown in what way they produce grave consequences; and those veterinary surgeons who had any experience of the disease in the Crimea, will be ready to agree with me that an attack of "mange," accompanied by debility, was in only too

		Females.		*Males.*
1st generation after	15 days...	10	...	5
2nd „	„ 30 „ ...	100	...	50
3rd „	„ 45 „ ...	1,000	...	500
4th „	„ 60 „ ...	10,000	...	5,000
5th „	„ 75 „ ...	100,000	...	50,000
6th „	„ 90 „ ...	1,000,000	...	500,000

Thus a male and female will produce 1,500,000 descendants in about three months.—*Krätze und Räude.*

The reproductive powers of a species, as Verheyen observes, march with its chances of destruction; when "mangy" animals are not treated for the disease, these chances with the parasites are fewer than with many other invertebrates; and if we are to judge from the extent of the crusts, and the number of parasites necessary to produce and maintain them the enormous multiplication made by Gerlach does not appear exaggerated, and the acari must be admitted to exist in millions.

* Dupont has reported the existence of Scabies among droves of horses kept in France to feed leeches upon; these poor animals are not only maintained in the very worst condition, but they are enfeebled almost to the last degree by the bites and loss of blood the leeches inflict. The people who associate with them are often affected with the disease by transmission.

many instances the precursor of death. Scabies is, therefore, most formidable during a campaign, particularly in winter, or in cold tempestuous weather; but not so much from the actual mortality it causes, as from the loss of condition it entails, and the consequent diminution in usefulness of the animals affected. The transmissibility to mankind must not be overlooked.

IMMUNITY.

Horses well-groomed and fed, and in good condition, are much more likely to escape infection than those which are not so circumstanced. If all are placed in the same conditions, however, with regard to exhaustion and hardship, very few will escape contamination.

SANITARY MEASURES.

The sanitary measures necessary for the suppression of Scabies in the horse, must be self-evident to those who have studied the cause and the manner of its diffusion.

To prevent the invasion of the disease, the same precautions should be adopted as those for Glanders and Farcy.

Horses affected with Scabies, especially the Sarcoptic and Psoroptic forms, should be completely isolated from the healthy, and submitted to treatment by a veterinary surgeon ; and those animals which have been in contact with them ought to be kept under observation for at least sixteen days, every necessary care being exercised in that interval.

The stables, utensils, clothing, grooming articles, &c., should be well cleansed and disinfected. The litter should be destroyed; the walls, partitions, mangers, floors, &c., should be well limewashed ; and all harness and clothing, after being well cleaned, should be dressed with a strong solution of carbolic acid.

The predisposition, and all causes of debility, should be attended to in horses not yet affected. Of all the measures applicable in this direction, the principal are a sufficient quantity of good food and proper hygiènic management, especially cleanliness.

CURATIVE MEASURES.

The immediate cause of Scabies being parasitic, the curative measures must be directed to the destruction of the parasites in as short a period as possible, at as little expense as may be necessary, and without inflicting any injury upon the horse, or exposing it to any risk of permanent damage.* Many parasiticides have been employed and recommended, but it would be beyond our aim to notice them all; and more particularly as several of them are dangerous, and as likely to kill the patient as the parasites, or to produce a diseased condition of the skin much more intractable to remedial measures than Scabies. Therefore care is necessary in selecting a remedy.

* Gerlach, in order to discover the best parisiticide, undertook a series of experiments with a large number of medicaments, placing the acari under the microscope and watching the effects of the application upon them. The following were the results he obtained :—The acari were killed in $\frac{1}{4}$ to $\frac{3}{4}$ of a minute, by pure creosote and benzine; in $\frac{1}{2}$ to $2\frac{1}{2}$ minutes, by creosote more or less diluted with water (1 to 40 to 80); in $\frac{1}{2}$ to 9 minutes, by creosote ointment or liniment (1 to 20 to 40 of lard or oil); in 1 to 2 minutes, by pure tincture of iodine; in 4 to 6 minutes, by a diluted tincture of the same (1 to 4 of water); in 2 to $2\frac{1}{4}$ minutes, by solutions of caustic potass (1 to 24); in 5 to 9 minutes, by spirits of turpentine and oil of tar; in 1 to $1\frac{3}{4}$ minutes, by glacial acetic acid; in 2 to $3\frac{1}{2}$ minutes, by diluted acetic acid (equal parts); in 7 to 8 minutes, by strong sulphuric acid to which 24 parts of water had been added, and in 32 to 35 minutes, by that to which 48 parts had been added; in 10 to 20 minutes, by an infusion of tobacco (1 to 5); in 15 to 30 minutes, by solutions of sulphur and potass (2 to 10); in 8 to 13 minutes, by tar; in 15 to 45 minutes, by a solution of corrosive sublimate (50 centigrammes to 32 grammes); in 7 to 25 minutes, by Tessier's arsenical solution; in 16 to 65 minutes, by Mathieu's arsenical fluid; in $\frac{1}{2}$ to 1 hour, by soft soap; in $\frac{1}{4}$ to 1 hour, by liquor ammonia; in 2 to 3 hours, by a watery solution of arsenic (1 to 6); in 4 hours, by strong mercurial ointment; in 2 to 5 hours, and in 4 to 10 hours, by decoctions of tobacco (1 to 10 and 1 to 50); in 3 to 36 hours, by decoctions of black and white hellebore (1 to 16); in 6 to 48 hours, by Walz's composition; in 12 to 16 hours, by decoctions of henbane or belladonna (1 to 16); and in 24 to 6 hours, by infusion of digitalis (1 to 16).

Bourguignon found, from a similar series of experiments, that the iodide of sulphur, a solution of iodide of potassium, and the extract of stavesacre, were very powerful parasiticides.

Before this is applied to the skin, particularly if the disease is of some duration, it will be advantageous to first soften the crusts with oil, and to well wash the surface of the body with warm water and soft soap. The parasiticide may then be applied. It may be in the form of lotion, liniment, or ointment, as convenience or circumstances may require. A number of lotions are recommended by Röll: they are, a strong wash of caustic potass (one to fifty of water), a concentrated solution of liver of sulphur (one to twenty-five of water), diluted sulphuric acid (one of concentrated acid to twenty-four of water), a decoction of tobacco (one to twenty or twenty-five of water), and a lotion of creosote (one to ten of alcohol, and twenty to thirty of water).

In the Crimea, where doubtless much injury was sometimes done by injudicious treatment (smearing the skin with strong dressings of Stockholm tar), I found the sulphuret of calcium lotion very effective; but it generally required more than one application, gave gray horses a very singular tint, and though it cured the disease, it caused the skin to wrinkle and become harsh and dry for a long time afterwards.

As a liniment, the creosote dressing (one to thirty of oil) is good. My ordinary prescription is in the following proportions:—Common oil, one pint; oil of tar, one ounce; sulphur, one ounce. These are mixed, and allowed to stand in the sun or by a slow fire for some time, and frequently shaken. To be applied in the sun, with plenty of friction, and washed off with soap and water in four or five days. I am entirely in favour of liniments, after a long experience of the three forms, being convinced that they possess advantages which the others have not. If there is any obnoxious ingredient which might do harm if absorbed when applied as a lotion, there is less risk when it is used in this way; and the oily menstruum, while acting as a safeguard, is beneficial in several other respects. Röll recommends wood tar and sublimed sulphur, half a pound of each; and soft soap and alcohol, a pound of each. This mixture is to be rubbed into the skin by means of a brush, and if the skin is very sensitive, a quarter of a pound of pulverized chalk is to be added. The horse is allowed to stand in the stable for six days

well covered; at the end of this time the dressing is washed off by means of water and soft soap. Röll has employed this treatment for years, and it is only in rare cases, even when the disease is inveterate, that he has to resort to a second application.

The preparations of sulphur are generally very effective, and those dressings which have this as their base are most useful and least injurious. The "pommade d'Helmeric" has been highly extolled as a parasiticide in sarcoptic and psoroptic Scabies; and Mégnin, who tried applications of sulphur-soap, petroleum, carbolic acid, tobacco, pyrethreum, &c., gives this the preference, many of his cases being cured by a single dressing, though some inveterate cases required two and three—never more. It never produced that kind of artificial Lichen which other dressings containing irritating agents are too apt to engender; on the contrary, when the skin was well washed with soap and water a few days after its application, it was found to be clean, supple, and entirely free from disease, so that the animals could be immediately utilized.* Mégnin justly condemns carbolic acid as a dangerous remedy.

Stavesacre, in the form of ointment, has been recommended; but it is more expensive, and for the horse does not present any greater advantages than other simpler and cheaper compounds.

Whatever dressing be adopted, if the disease is sarcoptic Scabies, too much care cannot be observed in applying it thoroughly: not only to those parts of the skin which are really diseased, but also those which are, to all appearance, unvisited

* This pomade is composed of lard, two pounds; sulphur, seven ounces; carbonate of potass, seven ounces.

Fritscher recommends a pomade which has been largely employed among the Bavarian army horses. It is composed of the following ingredients:—Mercurial ointment and sublimed sulphur, of each four and a half ounces; two and a quarter ounces pyrogenous animal oil; hempseed oil, one and a half pounds. This is to be applied over the whole surface of the body, which is then to be warmly clothed. In two days, the pomade still clinging to the hair is to be rubbed again into the skin by a firm hay wisp. The treatment is to be continued until the tenth day; and on the eleventh, the skin is to be cleansed with soap and water.

by the parasite; the dressings, indeed, should be applied in a general manner to all parts of the body without exception—between the jaws, thighs, forelegs, under the abdomen—the entire cutaneous surface, in fact; for if any portion be left undressed, the malady will, in all likelihood, again appear in a very brief space.

Psoroptic Scabies does not usually demand such extensive dressings: the habits of the parasite, and the sharply-defined boundaries of the malady, rendering their application to any other than the visibly affected parts unnecessary. Consequently, tar ointments, in combination with sulphur, may safely be employed on these localized patches. The same may be said with regard to symbiotic Scabies.

The dressings should remain on the skin for six or eight days, before removal by a good lather of soft soap.

In inveterate cases accompanied by much alteration of the skin and emaciation, it is generally most advisable to give arsenic in small and frequently-repeated doses.

Good food and cleanliness are essential accessories.

SCABIES IN THE BOVINE SPECIES.

As has been mentioned, the Scabies of the ox is not of great moment in a sanitary point of view, and is due to two parasites—the Psoroptes, Dermatocoptes or Dermatodectes, and the Symbiotes or Dermatophagus—each producing its own particular symptoms. The Sarcoptic form of the disease is rare in this animal; and nothing appears to be known of the bovine sarcoptes. The disease chiefly affects the head and neck.

SYMPTOMS.

1.—*Psoroptic Scabies.*

The symptoms of this form are similar to those of the horse. At first intense pruritis, soon followed by the appearance of vesico-papulæ; these are generally first observed about the withers and root of the tail, and soon extend to the sides of the neck, head, back, loins, shoulders, sides of the trunk, and eventually the whole body, except the limbs. The hair falls off, the skin becomes thickened and hard, it corrugates, and

cracks and fissures appear in it. At the same time the continuous and severe itching causes the animal to paw and kick, rub itself against the walls or anything it can reach, and to lick the skin with its rasp-like tongue. From all this arise wounds and abrasions, and the exudation from the skin forms crusts with the broken-up epidermis, among which the parasites revel and propagate.*

* Gerlach, in his work published in 1857, describes the bovine psoroptes, which he had recognized in crusts sent to him for examination ; but he had not seen the disease.

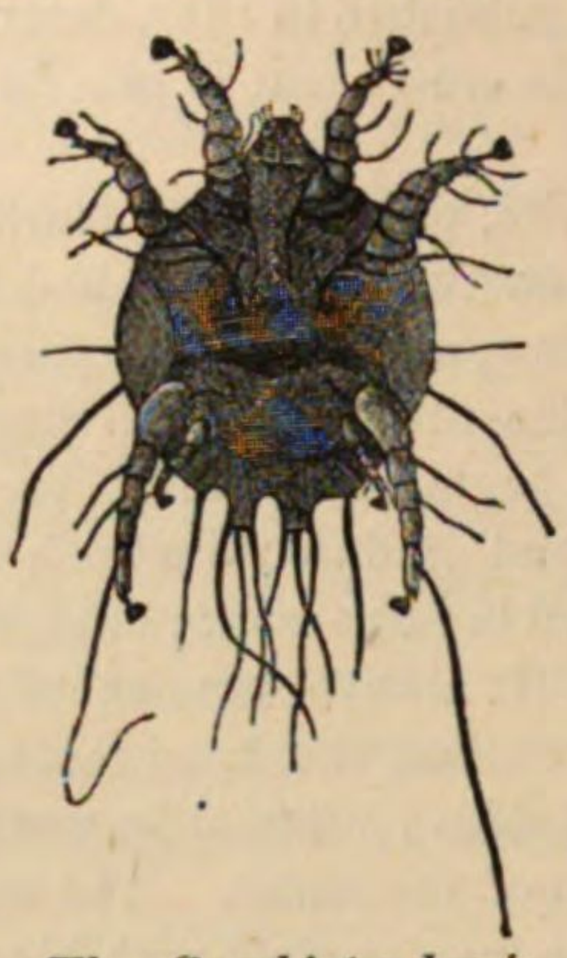
In 1860, Müller, of Berlin, published (in Gurlt and Hertwig's "Magazin") some observations on the Scabies he had studied in a herd of oxen in the district of Inowraclaw, and which had prevailed for several consecutive years. This affection always showed itself towards the end of autumn, when the cattle begin to be housed for the winter ; reached its worst stage in February; and gradually diminished as the spring set in, and the animals were employed in farm-work ; until, when the summer arrived, it had quite disappeared. It always commenced at the root of the tail and sides of the neck ; soon reached the head and upper part of the body, as well as the shoulders and sides ; when at its worst, the entire body was involved, with the exception of the limbs. The animals rubbed and licked themselves until the skin was marked with bleeding patches ; these became covered with pellicles, and the integument itself gradually thickened; the hair was shed ; and when the disease was severe the creatures became cachectic, and the more aged among them died. In the spring, the crusts became detached ; new hair appeared, except in patches here and there at the root of the tail and neck ; at the same time, the skin grew scurfy about the back of the head and around the base of the horns. At last, Gerlach and Müller were called in to examine the diseased oxen, when they discovered the psoroptes, and satisfied themselves that the parasites were present in summer as well as in winter : although in that season the animals appeared to be perfectly recovered ; and that they then clustered in great numbers behind the head and around the root of the horns. Dwelling in warm sheds during the winter appeared, therefore, to favour their development and multiplication.

Röll states that one year, towards the end of the autumn, two white buffaloes—a bull and cow—belonging to the Vienna Zoological Gardens, were sent to the Veterinary Institute of that city. These animals had the sides of the neck and body almost entirely denuded of hair, the skin was covered with scales and small crusts, but there were no thick patches of exudation. Everywhere the skin was moderately hypertrophied, but the pruritis was considerable, especially in the cow. The unaided eye could distinguish the parasites moving about rapidly on the skin ; they were also found on the under surface of the crusts.

This bovine parasite does not appear to be transmissible to man or the horse.

2.—*Symbiotic Scabies.*

In this form of bovine Scabies, we have a parasite analogous to that which produces the same variety in the horse; though it is not found in the same regions, being generally located at the base of the tail, where it occasions a somewhat intense pruritis, and where an abundance of epidermic pellicles



The *Symbiotes bovis.*

may be observed. The hairs also break and fall off; gradually crusts appear; the skin cracks in circumscribed patches, and in these fissures are discovered numerous acari. Through absolute neglect of cleanliness, the disease may extend from the tail towards the back, and even as far as the neck, and to the inside of the thighs and udder; though, as a rule, it remains localized for years at the base of the tail and the fossa in the vicinity of the anus (for which reason Gerlach designated it "steissraude" of the root of the tail).

The disease is not very readily transmissible to other bovines; it is therefore of little importance, being almost purely local and individual. Neither does the parasite thrive when transferred to the other domesticated animals, or to the human species. Transported to the pasterns of a horse, it caused neither eruption nor pruritis.

SANITARY MEASURES.

These should be the same as for Scabies in the horse.

CURATIVE MEASURES.

Cleanliness should be enforced, and this alone will remove Symbiotic Scabies. The Psoroptic form, however, may require dressing with some parasiticide remedy. Müller was successful in curing it by thoroughly cleansing and rubbing the skin with soft soap, which was left on until the following day, when it was removed and a decoction of tobacco applied. Röll's cases were cured by one dressing of tar liniment, followed in six days by a good washing with soap and water.

SCABIES IN THE OVINE SPECIES.

In the sheep, owing to physical and economical considerations, Scabies is a most important malady, and one which has attracted attention from the earliest times; though not nearly so much as in later years, when this animal, as a food producer, and also because of its fleece, has become so wonderfully increased in value, and is of such consequence in some of our colonies. As we have said, the sheep is affected with three varieties of Scabies, only one of which, to my knowledge, has been recognized in this country. These are the Psoroptic, Sarcoptic, and Symbiotic forms. As the first is by far the most important, we will notice it at greater length.

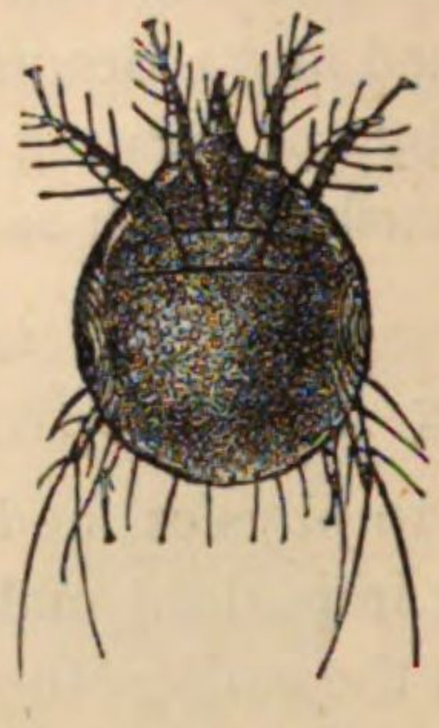
SYMPTOMS.

I.—*Psoroptic Scabies.*

This form of Scabies is produced by the *Psoroptes* or *Dermatocoptes ovis* (Gerlach) or *communis* (Fürstenberg). It is the generally recognized form of "scab," and sometimes affects entire flocks. It is a very common ovine malady, and is generally dreaded; as it causes most serious loss sometimes, and always occasions much trouble and anxiety to shepherds and flock masters, not only from the damage it causes to the sheep immediately affected, but from its great contagiousness. Therefore it is that a knowledge of its earliest symptoms is most important.

The first indication of "scab" is that of pruritis: the animal rubbing itself against posts, fences, hedges, trees, hurdles, or

anything it can reach, and attempting to bite or scratch the affected part with its hind foot. This gives the fleece a characteristic appearance, known as "flowering" by the Border shepherds, which is produced by tufts of the wool being pulled out, leaving white patches. Stains of soil can also be perceived on the wool about the shoulders and neck, when the



The *Psoroptes ovis.*

hind feet are employed to scratch these parts. The fleece soon looks ragged and tufty ("mécheuse" according to the French shepherds) on the places which are rubbed; the wool is agglutinated at certain points, absent in others, or easily removed. The sheep is restless and nearly always on the move: stamping, rubbing, or scratching to obtain relief; it frequently turns its head round, snaps at its body, makes peculiar gnawing movements with its jaws, or pulls out the wool with its mouth; and if the skin is rubbed by the hand, it manifests the greatest delight, stretching out and shaking its head and neck, moving its lips in a convulsive fashion, and even attempting to bite those who induce these symptoms.

When the animals are heated, these symptoms are exaggerated.

The experienced shepherd and inspector have no difficulty in recognizing the malady at this stage; a few minutes' watching being sufficient to discover the existence of the disease in the animal's movements, while the condition of the fleece affords corroborative evidence.

If the wool be parted at the places above-mentioned, there

is remarked, on the surface of the skin, a slightly prominent point or papule, about the size of a lentil, and of a pale or reddish-yellow colour. A little vesicle is soon developed on the summit of this papule, and this discharging its serous contents, a small crust or "scab" of the same tint is formed; at a little distance from this the psoroptes, which has produced the vesicle, may be found among the fibres of the wool.

The usual situation of Scabies is along the back, from the neck to the tail, and sides of the body and the shoulders—those parts, in fact, where the parasite is moist sheltered by a thick covering of wool; it rarely reaches the chest, lower surface of the abdomen, inside the thighs, or the limbs.

The vesicles, though isolated at first, soon become confluent, and even pustular, through the multiplication of the parasites; and the incessant rubbing and scratching tears out the wool in tufts, irritates, inflames, and excoriates the skin, and causes a great amount of exudation which, becoming dried, increases the thickness of the crusts, and unites the whole into one patch of Psoriasis. Beneath and on the borders of this, the parasites dwell and multiply; and when the crusts are removed, the wool, if it yet remains, comes away readily with them: leaving the subjacent skin thickened and wrinkled, and for a long time inflamed and scaly.

The crusts sometimes attain a great thickness, through the increased production of the epidermis, its continued exfoliation, and the exudation taking place on its surface. In their immediate vicinity, the skin is inflamed to a variable extent, from the action of the numerous acari which are continually moving onwards as the crusts are formed.

With shorn sheep there is usually a thick, dry, parchment-like crust covering the greatly-tumefied skin.

At a late stage, when the disease has become general, the wool has nearly or altogether disappeared; the integument is considerably thickened, wrinkled and fissured, and may even be ulcerated; the submaxillary lymphatic glands, and those of the axilla and inguinal regions and elsewhere, have become enlarged; and the visible mucous membranes are pale and unhealthy-looking. The animals become cachectic (the "Räude-

kachexie" of the Germans); fall into a state of marasmus, and at length die from exhaustion.

The acarus is readily discovered, owing to its size and numbers: being usually found on the surface of the skin, and at the margin of the dry crusts; or beneath those which are just forming, and are still moist.*

COURSE AND TERMINATIONS.

The progress of "scab" in the sheep much depends upon circumstances. With those not living in flocks, the disease commences at the part where the acari chance to be deposited: the other portions of the surface being only gradually invaded; but in infected flocks, where reciprocal transmissions are frequent, it may appear in several regions, and consequently extend with greater rapidity. As a new generation of parasites is usually perfectly developed within fifteen days, and as their numbers are thus notably increased, it may happen that during the first fortnight after infection the disease is limited to a small surface of the skin, and nothing is discovered, on examination, but a few nodules and thin yellow scales. If only a few acari have been transmitted, there may be nothing

* The veterinarian, Walz, who first, in 1809, drew attention to the Scabies of sheep and its propagation by a parasite, and also made a good study of the disease, thus alludes to it—"If one or more acari (female) are placed on the wool of a sound sheep, they quickly travel to the root of it, and bury themselves in the skin, the places at which they penetrated being scarcely visible, or are only distinguished by a minute red point. On the tenth or twelfth day, a little swelling may be detected with the finger, and the skin changes its colour and has a greenish-blue tint. The pustule is now rapidly formed, and about the sixteenth day breaks; and the mothers again appear, with their young attached to their feet, and covered by a portion of the shell of the egg from which they have just escaped. These little ones immediately set to work and penetrate the neighbouring skin, and bury themselves beneath it: finding their proper nourishment there, and growing and propagating until the poor sheep has myriads of them preying upon it; it is not wonderful that it should speedily sink. Some of the male acari were placed on the sound skin of a sheep, and they, too, burrowed their way and disappeared for awhile, and the pustules in due time arose; but the itching and the crusts soon disappeared, without the employment of any remedy."—*Natur und Behandlung der Schafräude.*

unusual observed for the first week after infection, particularly if the wool is long and thick. But as the parasites multiply, the pruritis, eruption, and other symptoms become developed; weakly animals, if recourse be not had to treatment, may perish a few months after infection; while those which are robust and well fed will, of course, withstand its ravages longer. The weather, state of the wool, the food, and other circumstances, influence the course of the disease; but a spontaneous recovery is far from common, and the worst results generally ensue if the malady be neglected.

DIAGNOSIS.

The manner in which the disease extends on the skin, the pruritis and other symptoms enumerated, and the presence of the acari, sufficiently distinguish this from any other cutaneous malady.

CONTAGIUM.

The contagium in this, as in the other forms of Scabies, is, of course, the parasite, as without it there would be no "scab."

The rapidity with which it operates, particularly in a flock of sheep, depends upon the number of parasites transferred to the animal first attacked. If they are few, they do not pass quickly from one sheep to another, but first make a shelter for themselves; if this be beneath a thick fleece, then it is all the more favourable for their multiplication. This being achieved, they immigrate from these centres; then ensues direct or indirect transmission, and the number of cases of sheep-scab begin to increase more or less rapidly, according to circumstances. These are generally a long thick fleece, damp or rainy autumns and winters, close packing of the sheep in warm buildings, poor and inadequate food, and hardships of every kind, for facility of transmission and multiplication. In summer, after the sheep are shorn, and if the weather be dry and the pasturage good, its spread is greatly checked.

Though extremely contagious between animals of the ovine species, yet the disease is not so with other animals. The

ovine psoroptes, though it closely resembles that of the horse and ox, yet will not live on these animals nor on the goat. On the skin of man it only produces a minute red spot, which never attains the development of a papule.

VITALITY OF THE PSOROPTES.

The vital resistance of the ovine psoroptes is very considerable, when the parasite is removed from the skin of the animal it infests. According to Hertwig, it dies in two hours when subjected to a temperature of 47° Fahr. but it will live in cold water for six, and in warm for ten days. Krogmann remarks, however, that the psoroptes of the sheep and cat will sustain a temperature varying from 29° to 59° for twenty-eight days. And Haupt alludes to an observation recorded in a Prussian veterinary journal, in which infection followed from putting healthy animals into a stable which diseased ones had inhabited eight months previously, but which had not been cleansed. Gerlach appears to think that four weeks should be allowed to elapse before the buildings, pastures, or roads frequented by diseased sheep are opened to healthy flocks.

MODE OF INFECTION.

Infection may take place directly or indirectly—directly, by the contact of diseased with healthy sheep; and indirectly, by means of buildings, pastures, wool, or any other medium which may harbour the parasites. The first-named is by far the most frequent; and infection takes place very readily if a shorn sheep affected with Scabies be introduced into a sound, but unshorn, flock.

INCUBATION.

The period that elapses between receiving the infection and the manifestation of the first symptoms, will depend, as has been stated, upon the number of acari transferred, and other circumstances. It has been found to vary from a week to a month. The number and the facility with which the parasites

multiply, of course influence the duration of this period. Their fecundity is astonishing, as we have already noted.

Walz deposited a pregnant female on a healthy sheep, and found young acari on the sixteenth day. Hertwig discovered them on the fourteenth, sixteenth, and eighteenth day. Gerlach employed two pairs of parasites, which he found coupling, and on the twelfth day observed a new brood, already half-grown, and ready to commence breeding; he calculated that a second generation might succeed the first, and become adults within from fourteen to fifteen days. A similar estimate might be formed of the ovine psoroptes as of the equine sarcoptes in this respect (*see* note, page 420). Fourteen days after a pregnant female psoroptes had been placed on the skin of a sheep, a number of papulæ were discovered on a patch about the size of a silver groschen; in four weeks this was larger than a thaler; and in six weeks it was as large as the hand, from a new eruption. Ten acari of both sexes deposited on the skin of the back produced, in from sixteen to eighteen days, a patch of "scab" more than three-fourths of an inch in diameter; in thirty-two days, there was another large patch near the first; and on the thirty-eighth day, a large portion of the back was involved. A pregnant female, in thirty-one days, produced a patch nearly two inches in circumference.

These facts and figures afford some evidence, not only as to what may be termed the "incubation" of the disease, but also as to its rapidity of extension.

EXTENSION.

As has been observed, the disease is rapidly propagated when circumstances are favourable; and long-wooled sheep are not only more readily infected than those which are short-wooled, but are generally those among which it prevails, and which extend it. One infected sheep may contaminate the entire flocks of a country by actual contact, or through the medium of objects against which it may have stood or lain. Pastures, roads, lanes, hedges, stables, trees, litter, posts, &c., tufts of wool adhering to these, and other media, have all at

times been looked upon, and in all probability justly, as capable of extending the disease.

Some countries, through carelessness or mismanagement, are never free from it. On the Continent these regions are generally well known, and much of the disease in this country is imported from them. Sheep-fairs are also largely instrumental in disseminating the parasites: either from affected animals mixing with those which are healthy, or indirectly through the pens which the former have occupied. Grazing on commons or unenclosed lands is another source of extension; as are also improperly disinfected railway trucks and cattle-boats. Flocks travelling by road are often very dangerous in this respect.

MORTALITY AND LOSS.

"Scab" very rarely disappears spontaneously, and if not submitted to curative treatment, sooner or later causes the death of those affected. Of course, it very seldom happens that the disease is allowed to end in this wa ywithout something being done to cure it: though only too frequently the remedies employed are more prompt in bringing about a fatal termination than the malady itself; so that we are left without any reliable evidence to guide us as to the mortality the disease is actually responsible for. In Germany, the loss is seldom less than ten per cent., and is more frequently more than twenty-five. May ("*Das Schaf*," vol. ii. page 429) states that in a flock of sheep numbering 400, within three years 300 had perished.

Even when the sheep do not die in any considerable numbers, the loss sustained from their becoming emaciated, and losing their wool, constitutes Scabies a serious scourge. Then there is the expense of treatment; the additional labour to be engaged; the contamination, and consequent disinfection, or evacuation for a certain period, of the pastures or buildings which have been occupied by the diseased flocks, &c., all of which often amounts to nearly their total value before the disease appeared.

In France, according to the statistical estimate made by

Delafond and Bourguignon, Scabies affects every year at least a million of sheep; and they reckoned their depreciation in value—wool and carcass—at five francs per head, which would give a total annual loss of 5,000,000 of francs.

The loss is not less in Bavaria and some other parts of Germany; and Haubner estimates it even as high as two thalers (six shillings) per head. Zundel reports a loss of 5000 francs in a flock of 200 sheep in three years.

Jacoby estimates the annual loss in wool from this disease in the Erfurt district (Prussia) at 30,000 thalers; and Fürstenberg calculated that, in the Griefswalder district, where the disease had not long been known, the loss every year was from 35,000 to 40,000 thalers.*

In 1859, according to Straub, the number of sheep affected in the Wurtemberg districts was 683,842 : 497 flocks being infected in that and the two succeeding years. Reckoning the loss at three or four thalers per head, it will be seen that a large sum of money was lost in this period. The deaths from marasmus and other complications, were very numerous in 1862.

When hygiènic measures are neglected, and the shepherds and sheep-owners are careless or ignorant, the loss must always be great, and especially when the infection is conveyed among large flocks.

IMMUNITY.

Very few sheep escape the disease when it prevails in a flock, unless great precautions are adopted. It attacks young and old irrespectively; though the aged and debilitated more quickly betray its effects. An animal may have many attacks.

2. *Sarcoptic Scabies.*

This variety of ovine Scabies has not been described in this country; and it has not been observed, it would appear, in Germany. It has long been known in France by the popular

* For the history and losses caused by this disease in England during many centuries, *see* "Animal Plagues."

name of *noir-museau*, and Chabert designated it "*dartre*;" but its parasitic nature was only made known in 1858, by Delafond, the parasite being analogous to the acarus of the human species. It is a peculiar disease. The first indications are observed on the upper lip, around the nostrils, and rarely on the eyelids and around the ears, by its appearing as a well-defined vesicle with a red areola. Very intense pruritis causes the animal to lick the lip, rub the parts against any object it can find, or scratch them with its hind or fore feet. The vesicle is in this way ruptured; the yellowish serosity it contains escapes, and forms a round, hard crust. Analogous papulæ and vesicles appear on the limbs which have been employed in rubbing the lip and nose; and these parts are soon covered with dense grayish crusts, beneath which the sarcoptes congregate. At a later period, the disease invades the whole of the face, cheeks, eyelids, and the lower portion of the limbs; though, strange to say, it does not attack those parts of the body covered with wool. The diseased patches extend, and become more numerous and coalesce; until at length such a region as the face presents only one large crust covering the skin, which is indurated, wrinkled, cracked, ulcerated, and bleeding.

At this advanced stage, respiration, vision, and even the prehension of food, may be obstructed by the thickness and size of the crusts, and the tumefaction existing around the natural openings. A fatal termination has not, however, according to Reynal, been noted.

3. *Symbiotic Scabies.*

Symbiotic Scabies has only been quite recently discovered to affect the ovine species; the veterinary professor, Zürn, of Leipzic, having described it this year (1874) for the first time. The parasite resembles the symbiot of the horse, though it is smaller. In those observed by Zürn, there were nearly as many males as females; and the insects were found among the crusts, swarming in numerous families, particularly at the lower part of the limbs, and in the hollow of the pasterns of

certain fine-bred, but neglected sheep—more especially those of the Negretti breed.

Like the symbiot of the horse, that of the sheep does not travel far from the part it first invades, until the numbers are so increased, that it is compelled to enlarge its domain; in this manner the local disease is gradually extended. This extension is, however, necessarily rather slow; and the malady is, consequently, not very contagious. After a somewhat long interval, during which the disease remains stationary, the skin becomes infiltrated; an exudation takes place from its surface, which is soon covered with crusts of a variable thickness; an eruption, followed by fissures, occurs in the pastern, and the shepherds believe this to be due to food too rich in salt—merely, it would, appear, because the disease is most prevalent during housing in winter.* It causes considerable itching, which is increased by warmth, and is most severe at night.

SANITARY MEASURES.

PERMANENT PRECAUTIONARY MEASURES.

To prevent the invasion of "scab" into a country, the same attention must be paid to the condition of the animals admitted as in other contagious diseases; though a mere cursory examination of a number of sheep—perhaps lasting only a few minutes—cannot be relied upon to detect the presence of the malady, which might only be in its latent state in one or two of the sheep. Animals from an infected country, unless intended for immediate slaughter, should be held in quarantine for a period sufficiently long to permit their condition to be thoroughly ascertained before they are allowed to mix with home flocks, or to enter markets except those for fat stock.

Should there be any infected sheep among imported flocks, the whole may be placed in quarantine until curative measures have suppressed the disease among them; or they may

* Wochenschrift, &c. Augsburg, 1874. Zürn first found the parasite among the thick crusts covering the limbs and scrotum of a ram suffering from what the Germans designate "Salzfluss."

be destroyed, their flesh used as food, provided it is not objectionable in quality, and their skin and wool disinfected by heat or other means.

The thorough cleansing of cattle-boats and railway-trucks is an important precautionary measure.

PREVENTIVE MEASURES.

The chief preventive measure is care, by farmers and graziers, in buying and introducing strange sheep into their pastures, or among their flocks. Such purchases should, if possible, undergo a period of quarantine of a few days in some convenient place, where there is no danger of communication with the others belonging to the farm, until their freedom from disease is assured.

Travelling flocks should be closely watched.

SUPPRESSIVE MEASURES.

Suppressive measures must be based on our knowledge of the disease and its infecting element—the acarus.

If "scab" appears in a flock of sheep, the whole should be considered infected, thoroughly isolated, and placed in the care of a veterinary surgeon for curative treatment.

This flock should not be allowed to graze within 200 yards (Röll) of other flocks, or of roads and pastures frequented by these. Local conditions will, of course, influence this and some other sanitary measures.

The grazing grounds (as well as the lanes and roads, if possible) on which infected sheep have been, should be interdicted to healthy sheep for four or five weeks.

The presence of the disease on a farm should be made known without delay in the district; for this purpose, the owner, or other person cognizant of the existence of Scab, should be bound by law, and under a penalty, to report the circumstance to the proper authorities.

The sale, purchase, and traffic in sheep should be strictly prohibited in the infected farm, or even in the locality, during

the existence of the disease; and no sheep—not even those for slaughter—should be moved from the infected place until every precaution has been taken that they are perfectly cured or free from the disease.

Sheep which are affected may be killed on the spot, if for food; those in a state of marasmus should be killed, and as the skin of sheep in this condition is usually of little value, the entire carcass must be buried.

When it is deemed necessary to destroy infected sheep in good condition, in order to prevent the spread of the malady, compensation to the full value should be allowed; but for those animals in an advanced stage of the disease, only a minimum sum may be allowed, or no compensation at all—this depending on circumstances.

When it can be proved that the disease has been introduced and allowed to extend through the owner's carelessness, or that of his servants, or that there has been any attempt at concealment, then the propriety of granting compensation should be considered.

The skin and wool of infected sheep may be safely utilized, if worth the expense, after exposure to the air in a dry, isolated place for two months; or in a very much shorter period, if exposed to a high temperature in a special chamber. After proper disinfection there is no danger; and, indeed, this cannot be very great, when we consider that the skins generally go to the tanner and the wool is packed up in bags.

Disinfection should be thorough, as every acarus and its ova must be destroyed, not only on the living animal's skin, but on all the objects with which it may have been in contact. Pastures must be disinfected by the weather for one to two months; but all posts, hurdles, or other rubbing-places may be lime-washed, or dressed with a solution of carbolic acid; as may also buildings, pens, stables, &c., which have been occupied by the infected sheep, as well as the floor of these places, if they are to be occupied at an earlier period than that just mentioned. All fragments of wool belonging to the diseased animals should be gathered and destroyed.

The curative treatment of the malady should be carefully conducted, and completely carried out; otherwise, the disease may linger for years in a district.*

CURATIVE MEASURES.

Ovine Scabies readily yields to rational curative measures, and to these, and careful isolalation of the diseased or suspected, attention should be mainly directed.

The cure of "scab" in sheep is subordinate to certain conditions. When only a few animals are affected, dressings applied by means of friction may be adopted; but as the disease usually invades entire flocks, this method of applying a remedy could not be conveniently carried out, except when a small number show urgent symptoms: these being dressed in this manner, those which are infected, but only slightly, escape until the disease has become more developed upon them. In this way the malady remains stationary—a most unsatisfactory and dangerous state of affairs. And the radical cure of an entire flock (for although all do not appear to be diseased, yet they

* The following Order of Council took effect after August 9th, 1871, the words in the Order having the same meaning as in the Act of 1869:—

"A local authority may, from time to time, with the view of preventing the spreading of Sheep-scab, make regulations for the following purposes, or any of them:—

"For prohibiting any person from having in his possession, or under his charge, a sheep affected with Sheep-scab, without treating that sheep, or causing it to be treated, with some dressing or dipping, or other remedy for Sheep-scab;

"For prohibiting or regulating the movements out of any field, stable, cow-shed, or other premises in which Sheep-scab has been found to exist, of any sheep that has been in contact with, or in the same field, stable, cow-shed, or other premises with any sheep affected with Sheep-scab;

"For cleansing or disinfecting sheds and places used by sheep affected with Sheep-scab;

"And may, from time to time, revoke any such regulations.

"3. Provided that the Privy Council, if satisfied on inquiry, with respect to any regulation made under this Order, that the same is of too restrictive a character, or otherwise objectionable, may direct the revocation thereof, and thereupon, as from the time specified in that behalf by the Privy Council, the same shall cease to operate."

may be infected, or suspected of being so, and therefore require to be treated like the others) can scarcely be hoped for unless the sheep are very short-wooled, or the operation is undertaken soon after shearing, and at a time of the year when the weather promises to be most settled; a long thick fleece, and cold wet weather are unfavourable to its success. Besides, the best mode of applying the remedy is by "dipping" the sheep in a bath, and the saturation of the wool in cold damp weather may cause internal disease. When, however, the results of the malady threaten to be serious, the remedies must be applied under any circumstances, and measures taken to guard against evil consequences. Ointments and liniments are not so easily applied as lotions and baths, when the wool is long; and they demand a longer time—always a serious objection when many sheep have to be treated. Topical applications are only to be recommended at the commencement of the disease when there are but a small number of sheep, or when in a flock only one or two are observed to be affected, and these are hurriedly isolated and dressed; though they may be usefully employed after the general bath in those cases in which a partial efflorescence reappears in one or two animals.

As the death of the parasite and its ova is the object to be achieved, and as the sheep is not a large creature, the discovery of a remedy which will most certainly destroy the acari, and within a brief period, without injury to the animal or its wool, and which at the same time is inexpensive and easily applied, has always been the aim of those who have made the disease their study. The object has not always been attained, however, for most pernicious remedies have been introduced by unskilled people at various times, and these have caused great injury and loss.

We need not in this place enumerate all the remedies which for many ages have been proposed; but will content ourselves with the enumeration of a few which have been largely put to the test, and have more or less fulfilled the requirements of an effective parasiticide.

Besides those dressings which have carbolic acid for their base (as McDougall's preparations), there are several which

have arsenic, as the celebrated French *bain de Tessier.* This bath, however, as it also contains a preparation of iron, reddens the wool; and this is a serious drawback. It is composed as follows:

Arsenious acid	1.00	kilogramme
Proto-sulphate of iron ...	10.00	„
Peroxide of iron	0.400	„
Gentian powder	0.200	„
Water	100.000	„

This mixture is boiled for eight to ten minutes, and poured into a bath-tub; and when it has reached a proper temperature, the whole of the sheep, except the head, is immersed and kept in the fluid for ten minutes. In the case of ewes which are suckling, the udder and teats are previously greased, to prevent the action of the astringent. Delafond reports that 36,000 sheep have been dressed with this dip without any ill effects being noted, and out of that number only sixty required to be dipped a second time. In order to obviate the staining of the wool (which can be removed by washing with soap), Clement has successfully substituted for the proto-sulphate of iron five kilogrammes of sulphate of zinc.

Mathieu recommends the following:

Arsenious acid	1 part.
Alum	100 parts.
Soft water	1000 „

Straub, during the epizoöty in Wurtemberg in 1859-63, reports the entire success of the following, and without the faintest symptom of poisoning in any of the sheep. It may be remarked that the men employed in dipping took the precaution to grease their arms with linseed oil previously, and that nearly always a single dip was sufficient, it being rarely necessary to have recourse to a second in three or four days:

Arsenic	1 part.
Alum	12 parts.
Water	200 „

The immersion lasted about three minutes. Generally in

from twelve to twenty-four hours after the bath, the skin became redder and more sensitive than usual, and there were afterwards formed small crusts, which fell off towards the sixth or eighth day. The wool was unaffected.

Zundel, an excellent veterinary surgeon at Mulhouse, during a serious attack of the disease in Alsace in 1865-66, was appealed to by the administrative authorities to aid in curing it. The graziers had tried several preparations of mercury and other prescriptions sold them by empirics, without success.

Zundel employed the following mixture :

Impure carbolic (phenic) acid ...	1500	grammes.
Quicklime	1000	„
Carbonate of soda	3000	„
Soft soap	3000	„

When these substances are mixed they form a thick paste or hard soap, which, when dissolved in 260 litres of tepid water, is sufficient for a hundred sheep. It is a very economical remedy, costing only about nine centimes for each sheep. The animals were immersed in the liquid, which was placed in a large tub, and their bodies well rubbed by a couch-grass brush ; two men and two assistants being necessary. The sheep seriously affected were dressed again in about three days.

Walz has introduced a bath which has for very many years been most successfully resorted to in Germany ; though, in the majority of cases, it has to be frequently repeated, and in inveterate outbreaks often fails. It is prepared by reducing quick-lime (4 parts) gradually into a fluid condition by means of water : carbonate of potass (5 parts), or ashes of beech-tree (60 parts), being added, with urine of cows to give it a proper (semi-fluid) consistency. To this mixture there is afterwards added pyregenous animal oil (6 parts), tar (3 parts), cow's urine (200 parts), and water (800 parts). For a flock of 200 to 250 animals, an allowance of half a pound may be made for each.

Gerlach recommends, as a preparatory dressing, a bath composed of two parts carbonate of potass, one of lime, and

five of water; and as a dressing proper, a decoction of tobacco in the proportion of one to twenty. For a flock, it is reckoned that at least an average of a litre and a-half (about three pints) is required for each sheep. For the preparatory bath, five pounds quicklime, ten pounds carbonate of potass, and twenty-nine or thirty gallons of water are sufficient; while for the parasiticide bath, fifteen pounds of common tobacco and thirty gallons of water are required.

Scheuerlé's modified liquid is composed of one part arsenic, twelve parts alum, and 200 parts of water: Straub's dressing.

The sulphuret of calcium, already mentioned as a dressing for horses, has also been recommended for sheep; but for various reasons it is not so efficient.

A solution of arsenic in water (one pound to twenty-four gallons) has been much used in this country. Another English recipe gives two ounces of arsenic, and the same quantity of carbonate of potash, boiled in a quart of water until dissolved; water being then added to make a gallon. A gallon of vegetable infusion is made by pouring a gallon of boiling water over four ounces of foxglove (digitalis) leaves, allowing the infusion to remain till cold, when it is poured off and added to the other. Half-a-pint of this is poured on the skin of the back and sides of the sheep: two or three dressings being required. According to Finlay Dun, the usual "dip" allowance for a hundred sheep is two pounds of arsenic dissolved in a hundred gallons of water; but he also mentions that three, four, and even five pounds dissolved in the same quantity of water are employed without evil effects. He recommends as a safe and convenient sheep-dipping mixture, three pounds each of arsenic, soda-ash, or impure sodium carbonate, soft soap and sulphur. We are informed that in many parts of England pearl-ash, or impure potassium carbonate, is substituted for the soda-ash; and that some farmers double or quadruple the quantity of the soap, which, with the alkaline carbonate, aids in dissolving the arsenic, while the sulphur whitens and softens the fleece, preventing, likewise, for a considerable time, the attacks of flies. Sometimes, with the same object, a pint or two of naphtha, or a little impure carbolic acid, is added. The ingredients are best

dissolved in from ten to twenty gallons of boiling water, and cold water added to make up a hundred gallons, which, with careful dipping, will dip about a hundred sheep.

Mercurial ointment has been employed for many years : the common ointment being rubbed down with three times its weight of lard for inveterate cases, and five times for mild ones. The wool is parted along the back from the head to the tail, and the ointment applied with the finger ; a similar parting and application being made along the sides four inches from the first, and so on for the whole body : about two ounces being used for each sheep, a lamb requiring about one-third the quantity of a full-grown sheep.

Another dressing is composed of corrosive sublimate half-a-pound, white hellebore powder three-quarters of a pound, whale or common oil six gallons, resin two pounds, tallow two pounds. The two first are to be mixed with a little of the oil : the others being melted together, and the whole then gradually added. This requires care in its application.

These are but a few of the remedies which have been from time to time proposed for, and employed in, the cure of this disease in sheep; and they are all more or less efficient, if carefully and properly applied. With the majority, from the poisonous character of some of the ingredients, this care is most essential, and the head should not be immersed. In bad, and even in mild, cases, it is generally very advantageous to first wash off the crusts by means of soap and water applied with a brush, or a preliminary washing with Gerlach's preparatory bath, before applying the dressing proper. Or the removal of the crusts may be effected by brushing while the sheep is undergoing the anti-parasitic bath.

The mode of applying the bath varies with the convenience and circumstances of the proprietor—from a simple tub or box into which the animal is lifted and dipped, to a specially constructed pit containing the dressing, into which the sheep enters by one side, and, after being thoroughly saturated, passes out at another. The last is, of course, much the best, as it obviates the risk of injury, particularly to pregnant ewes.

With a view to still further diminish the chances of injury,

different baths have been devised with an apparatus to lower and raise the sheep in the dipping well: the platform on which the animal stands descending or ascending as the operator requires.

After being thoroughly steeped with the dressing, the sheep are put into another tub or chamber, where the excess of liquid in the wool is removed by stroking, the use of a scraper, and pressing; at the same time, the parts most affected are thoroughly rubbed, in order to ensure the application of the dressing, and here the head may be moistened and rubbed. The surplus fluid is collected and returned to the dipping-bath, the contents of which should be maintained at a moderate temperature.

If the weather is warm and dry, the dipped sheep should be exposed to the sun in the open air; but if wet and cold they ought to be driven into a roomy and well-littered shed. If exposed to rain, even in warm weather, the dressing is soon washed off the skin; and if too cold, should there be no rain, the health may suffer. If possible, the best season should always be selected. This is generally early in the autumn, and in dry weather. If performed in the spring, it should be deferred until the season is well advanced.

A second or third bath, five or six days after the first, may be necessary if the sheep continue to gnaw and rub themselves; but partial efflorescences, or inveterate cases, may be treated by topical lotions applied with friction. It must be observed, however, that some dressings will produce a certain amount of pruritis for a short period after their application; or the sores in healing may cause the sheep to rub and bite. If the crusts have all been removed, however, and the itching persists, another bath must be given. Too much care cannot be exercised in inspecting the flock while it is under curative treatment, until every symptom has disappeared.

In applying nearly all the "scab" dressings, the men so employed incur more or less risk from the absorption of the active agents by the skin of their hands and arms. Caution must, therefore, be observed; and men should not be exposed to this danger if they have any wounds or sores on these parts.

In every case, it would be well to oil or grease the hands and arms.

In cases of poisoning among sheep from the action of the "dip," the wool should be removed from the skin as quickly as possible; or the surface of the body may be thoroughly washed and freed from the dressing, and the appropriate antidotes employed.

It may be remarked that poisoning is frequently brought about by turning sheep, with their fleece still dripping, into pastures or among fodder, which become impregnated with the dip, and, being eaten, produce the serious consequences so often noted, and which may extend to other animals. Finlay Dun, in noticing this accident, gives the following important practical recommendations:—

Yards into which newly-dipped sheep are to be turned, should be previously cleared of all green food, hay, and even fresh litter; if perfectly empty, they are still safer. When the dipping is finished, they should be cleansed, washed, and swept, and any of the unused dipping solution at once poured down the drains. Dipped sheep should remain, if possible, in an open, exposed place—as on a dry road, or in a large open yard. Overcrowding should be avoided, and every facility given for rapid drying, which is greatly expedited by selecting for the operation fine, clear, drying weather. On no account should sheep be returned to their grazings until they are dry, and all risk of dripping over.

When there is much loss of condition, an abundant allowance of good food should be given; and shelter from the weather, if it is inclement, should be afforded. Internal remedies are rarely necessary, and those of a depletive kind must on no account be prescribed.*

* It appears strange to find a "practical" agriculturist of some pretensions, in a "Lecture on the Diseases of Sheep," delivered, in 1872, in Norfolk—(*A Lecture on the Diseases of Sheep*, by Henry Woods, agent to the Right Hon. Lord Walsingham: London, Ridgway)—recommending *bleeding* the diseased sheep "to reduce the heat or quantity of the blood." This is certainly "practice" without science.

SCABIES IN THE GOAT.

The goat suffers from sarcoptic and, more rarely, from symbiotic Scabies. Müller observed an outbreak of the former among a number of African dwarf goats from Khartum, which were kept in the Menagerie of Schönbrunn, near Vienna. Their bodies were covered with crusts, and the itching was so intense that they were incessantly rubbing and gnawing themselves. On examination the *Sarcoptes capræ* were found in great numbers among the crusts. One of the keepers had also an eruption of Scabies on his hands.

In 1851 and 1853, the disease appeared in an epizoötic form in the valley of Prattigau, Switzerland, where Walraff described it. The head and ears became tumefied; around the lips and nostrils the skin cracked, and from the head the eruption reached the neck, back, sides, abdomen, and udder, and descending along the limbs only stopped at the hoofs. The pruritis was intense; and the goats scratched and rubbed themselves until no longer able, from exhaustion. The skin was covered with furfuraceous scales, which were succeeded by crusts, blue or reddish in colour, and the hair in some places had completely disappeared. The disease did not last beyond six months, and notwithstanding the appetite continued good, the secretion of milk ceased, emaciation set in, and this was the prelude to cachexy and death. Walraff adds that, when the carcasses were examined, the lungs were found to be studded with tubercles.

The disease was very contagious, whole families of people being infected; and horses, cattle, pigs, and sheep suffered from contact with the goats. In these animals it spread over the entire body, causing desquamation of the epidermis and loss of the hair. Its identity when transmitted to the sheep, was more perfect than in the other species; it attacked the head, ears, and those parts of the limbs least covered with wool; the ears became tumefied, cracked, and covered with crusts.

Müller has shown that the parasite can be successfully transferred to the dog.

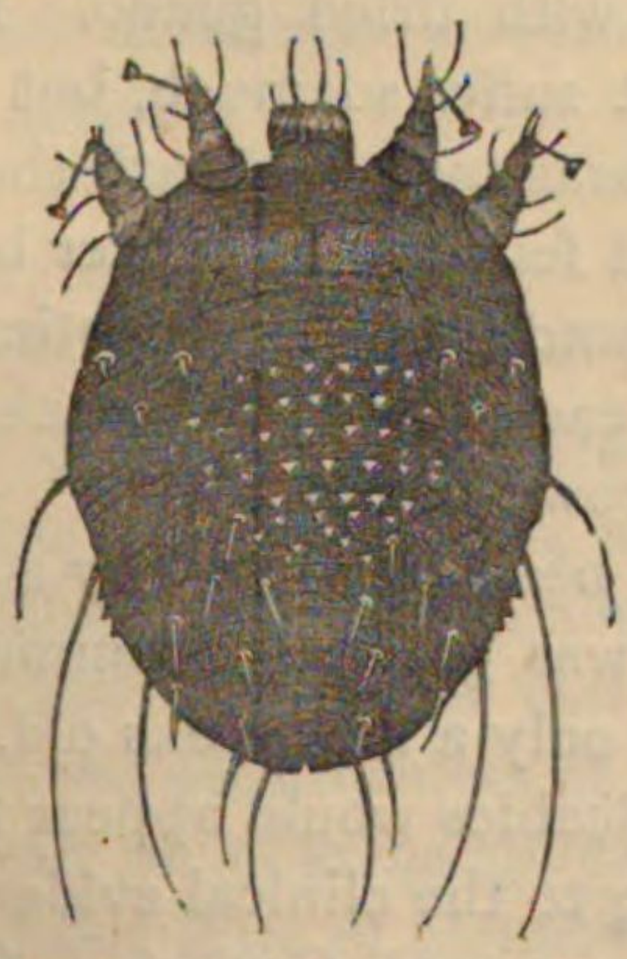
CURATIVE MEASURES.

The curative treatment for caprine Scabies should be the same as for that of the sheep; while the sanitary measures should also be identical.

SCABIES IN THE PIG.

The pig is affected with only one variety of Scabies—the "sarcoptic," due to the presence of the *Sarcoptes squamiferus* (Fürstenberg). The disease is somewhat rare, but it has nevertheless been studied by Gurlt (who discovered the sarcoptes on a wild boar in 1846), Spinola, Hertwig, Gerlach, Viborg, Müller, and Delafond and Bourguignon.

According to Spinola, very small red and close papulæ appear; then vesicles, which are ruptured by the biting and rubbing of the animal, leaving red exuding patches, or bleeding cracks in the skin. The bristles in the papulæ lose their lustre, and by their dull appearance indicate the seat of the disease; in a short time they fall off. The little red patches extend and increase in number, and as they do so the itching



The *Sarcoptes squamiferus*.

becomes more intense; the skin wrinkles, and there it ulcerates and suppurates, and crusts form. The eruption

invades the entire surface of the body, which at length appears to be enveloped in a crusty carapace; marasmus becomes rapidly developed, and the animal succumbs.

The exanthem appears to have a great resemblance to the sarcoptic Scabies of the horse; and from Viborg's description, it is chiefly located in the fossette near the eyes, and on the inner aspect of the thighs and legs. He had not observed vesicles, and attributes their non-appearance in this animal to the thickness of its skin. Gerlach describes the squamous crusts he collected on the hypertrophied, wrinkled, and bristleless skin of a boar affected with the malady.

Circumstances would seem to influence the symptoms, as all the observers have not described them alike. Delafond found the disease localized about the ears, and Müller saw it affect Chinese pigs generally. The whole surface of the body in these animals was covered with dry, grayish-white crusts of varying thickness, which were easily detached. Beneath these the skin was wrinkled and excoriated, and in some parts, particularly on the thorax and abdomen, it was hard, dense, and tumefied; in the other regions, and particularly at the root of the ears, there were cutaneous tubercles from the size of a pea to that of a bean. Some of the pigs looked as if powdered all over with dried guano. During cold weather the animals did not suffer so much, but at a later period the itching was most harassing. Beneath the crusts multitudes of sarcoptes, male and female—the latter being by far the most numerous—were found; and it was estimated that there were several millions on each pig. To the naked eye they appeared as minute bright-brown points.

The disease had been imported by a pig purchased during the winter, and it was gradually communicated to the other pigs, even to those only a few weeks old.

This variety of Scabies would appear to be transmissible to mankind, according to the clinical evidence of Vongemmeren, Bontekoc, Hekmeyer, and Gerlach. The latter found by experiment, however, that the exanthem produced by the parasites on the human skin disappeared spontaneously in a few days (six to eight); but when infected naturally, the

other authorities give about fifteen days for its subsidence. Ampach has seen it communicated to the dog.

CURATIVE MEASURES.

The curative treatment may be the same as for the animals already enumerated. Gerlach recommends an alkaline bath composed of carbonate of potass one part, quicklime two parts, and water twenty-five parts,—to be repeated once or twice at intervals of five days. In obstinate cases the skin may be rubbed with a pomade or liniment of creosote, and after a few days the alkaline bath may be employed.

Pichon has been successful with a dressing of liquid carbolic acid one part, soft soap ten parts.

The sanitary and hygiènic measures are those pertaining to isolation, cleanliness, and extra nourishing food, if there is any tendency to debility and wasting.

SCABIES IN THE DOG.

There are two varieties of Scabies in the dog—that produced by the *Sarcoptes canis* ("sarcoptic scabies"), and that caused by the *Demodex caninus*, or *Demodex* or *Acarus folliculorum* (or "follicular scabies").*

SYMPTOMS.

1. *Sarcoptic Scabies.*

The symptoms of *sarcoptic Scabies* are analogous to those observed in other animals: red points, papulæ and vesicles, followed by scales, crusts, and thickening and wrinkling of the skin, with loss of hair. But from various circumstances—such as the thickness and sensitiveness of the skin, breed, &c., the order in which these phenomena appear is not very regular. If the skin is fine and destitute of pigment, there are observed red points like flea-bites: these are more particularly noticed on the abdomen. The pruritis that accompanies the appear-

* Bendz and Nicolet have discovered the symbiotes on the dog.

ance of these points and the scratching it excites, heightens the redness of the skin, which is soon covered with minute red papulæ about the size of a grain of millet, that also increase the efflorescence. This is sometimes designated "red mange," and it does not appear to be very well known in this country that it is due to a parasite. In thick-skinned dogs, the papulæ are larger. In a short time scales form, the skin becomes thickened and wrinkled, and the hair falls off; but there is no exudation ("dry mange").

In the majority of cases, small vesicles form on the papules and rupture, the contents producing yellow crusts; or, if they are pustular, the crusts are thick and dark-brown in colour ("scabby mange"). The pustular eruption is common in well-fed house-dogs with fine thin skins, and it shows itself chiefly on the abdomen, flanks, sexual organs, and inner surface of the thighs. As the disease progresses, a slight exudation occurs on the surface, the skin is damp, and drops of fluid collect on it like perspiration ("watery mange"). These differences are due to the texture of the skin. The hair falls off,—the skin becomes infiltrated and ridged, especially on the head and back; crusts and cracks appear, and abrasions, caused by scratching and gnawing, further damage the cuticle.

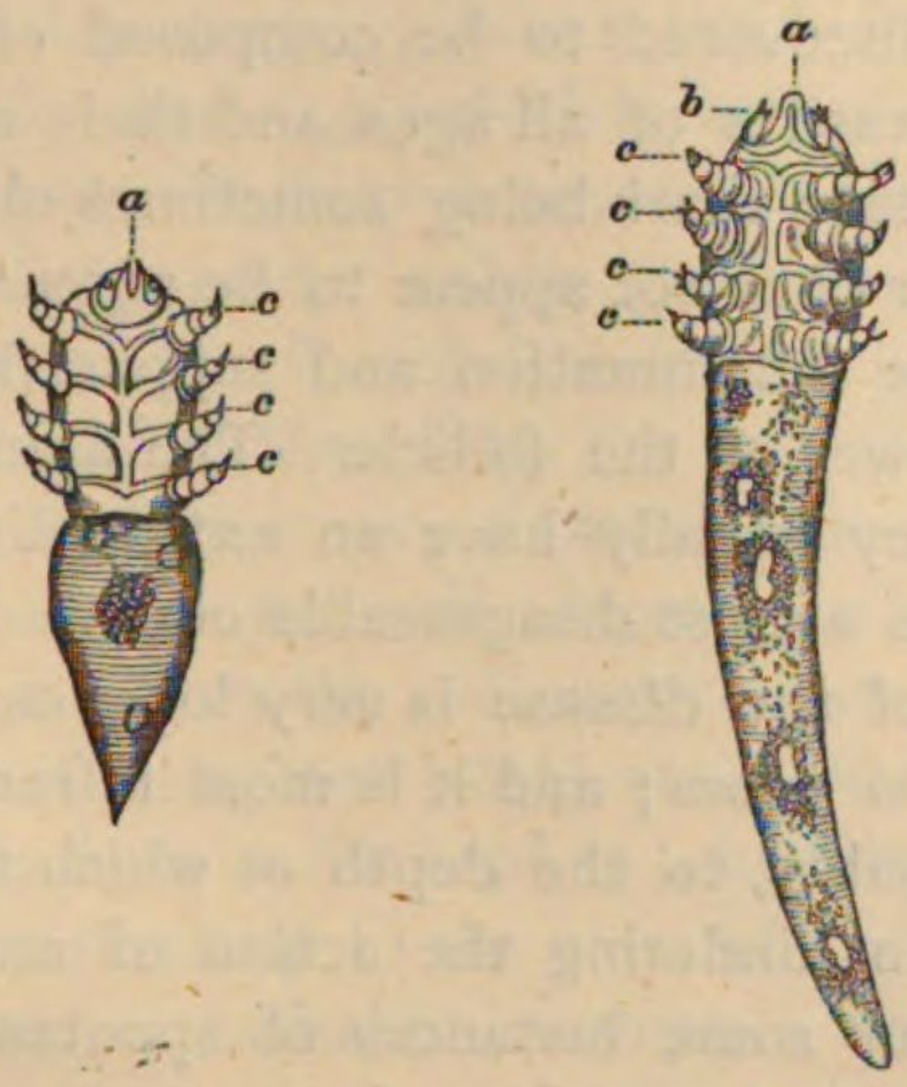
The disease may commence in any part of the body, but it is generally first observed on the face, eyebrows and eyelids, and ears. It extends rapidly, and in four or six weeks the whole body may be affected; it is then destitute of hair, and covered with crusts. When it reaches an advanced stage, there is great emaciation; and in inveterate cases marasmus may be the prelude to death.

In many dogs, probably in consequence of the violent irritation of the skin, there is an ekzematous eruption, which may be independent of the immediate action of the parasites.

2. *Follicular Scabies.*

The symptoms of *follicular Scabies* are due, as has been stated, to the presence of a parasite—the *Demodex* or *Acarus folliculorum*—which inhabits the sebaceous and hair-follicles of the dog. It has also been found in man, and Oschatz dis-

covered a similar parasite in the palpebral glands of the sheep. Gruby transferred the demodex of man to the skin of a dog, and found that it not only lived but propagated. He kept the dog for two years, and in that time all the hair-follicles had become invaded, and the hair had completely disappeared. An identity of conformation does not also necessarily imply a specific identity; the *Acarus folliculorum* of man inhabits the sebaceous-follicles of an almost hairless skin; while that of the dog infests the hair as well as the sebaceous-follicles—and the first does not produce the disturbance constantly caused by the latter. It would be interesting to discover, by further experiments, if the dog obtains its parasite from man.



The *Acarus folliculorum*. Mature specimens.
a, Mouth; *b*, Papillæ on each side; *c*, Feet.

The symptoms it produces have been compared to those of *Prurigo senilis* in the human species.

At first there is slight and circumscribed tumefaction of the skin, with an increase in its temperature; and if it is white, there are observed little red patches, which are not long in becoming confluent. These are covered with little tumours, due to the inflammation of the follicles,—an exudation takes place, and if one of the tumours is squeezed a small quantity of serum, or, at a later stage, pus, escapes. At this period the body

is studded with closely clustered pustules, whose diameter varies from that of a lentil to a pea; scales, and then crusts appear on the thickened skin, which cracks and fissures as in sarcoptic Scabies, and the hair is shed.

The malady most frequently commences at the head, especially towards the cheeks and lips; though sometimes it also begins on the under side of body with the male, or about the genital organs, or the loins. The itching is not very troublesome, the dog only scratching or rubbing itself now and again; though this scratching is painful, for instead of the creature appearing to be relieved by it, as in ordinary mange, it emits cries of pain. When a hair is pulled out and its bulb examined in the microscope, a demodex is seen on it; the liquid in the follicles is also discovered to be composed of pus and fat globules, with parasites of all ages and their ova: as many as fifteen or eighteen acari being sometimes observed in one follicle. The hair does not appear to be regenerated, according to Weiss: the inflammation and suppuration destroying the formative power of the follicle. The animals lose condition, though they usually have an extraordinary appetite; and the skin emits a most disagreeable odour.

The duration of the disease is very long, cases continuing for more than two years; and it is most refractory to treatment, owing, probably, to the depth at which the parasite is lodged in the skin hindering the action of remedial agents. Cures are rare, but some instances of spontaneous recovery are on record, the acari perishing from some unknown cause. A case is mentioned by Weiss, of a pregnant bitch which was affected with the malady,—it aborted, and very soon the pustules vanished, an abundant desquamation left the surface of the skin smooth and level, and the parasites could no longer be found. The animal, however, was so exhausted that it died.

CONTAGION.

The "sarcoptic Scabies" of the dog is transmissible to the human species, and numerous cases are recorded in proof of this, as well as in evidence of the similarity of the disease pro-

duced in both. The only difference, indeed, between the human and canine Scabies is in their resistance to remedies. The eruption produced by transferring the *Sarcoptes canis* to the skin of man is not persistent, but spontaneously disappears in two to four weeks.

Attempts to transmit the disease to the sheep and cat have proved unsuccessful; but with the horse, ox, and pig, an ephemeral eruption, it is believed, has been produced. Chabert, however, speaks of a troublesome form of Scabies being communicated from the dog to the horse and sheep.

"Follicular Scabies" is not nearly so contagious as the sarcoptic form; indeed, an affected dog may cohabit with others for some time without extending the disease.* The animal whose case is described by Weiss lived for from eight to fifteen days with other dogs, which remained unaffected. This feature in follicular Scabies is accounted for by the situation and habits of the parasite, and its conformation. Burrowing deeply into the follicle, it only leaves its habitation, in all probability, when carried from it by the fluid thrown out in the follicle; for its limbs are very short, and are not furnished with suckers; so that it is not well adapted for travelling: differing in this respect from the ordinary acarus. Nevertheless, in some instances, the slightest accidental contact will suffice for its transference from a diseased to a healthy dog; and when conveyed experimentally to the skin of the latter, it propagates in a very remarkable manner. Haubner deposited several, with a view to elucidate the contagiousness of the affection; and he found that, in about twenty-four hours, there was a slight tumefaction of the skin where they had been placed; in forty-eight hours the follicles contained a purulent fluid, in which young and adult acari and ova could be perceived. The eruption extended; but eventually the parasites disappeared, and a spontaneous cure took place.

SANITARY MEASURES.

These are isolation, disinfection, and cleanliness.

* This fact will serve to explain why the contagiousness of Scabies has been denied and affirmed by different authorities in this country, where only one kind of parasitic "mange" has been hitherto recognized in the dog.

CURATIVE MEASURES.

The remedies proposed for Scabies in the dog are exceedingly numerous, and it would be altogether beyond our object to attempt an enumeration of even a tithe of them. They consist of baths, liniments, and ointments. Among the former may be mentioned the sulphuret of potassium, one part to five of rain water. Also corrosive sublimate, one part to fifty of water; carbolic acid, in the proportion of one to forty of soapsuds or glycerine, is also a good remedy, but requires care. The liniments are, perhaps, better applications than either the baths or ointments. A very good preparation is the following:—Oil of tar, one ounce; sulphur, one ounce; common oil, one pint. To be allowed to stand in the sun, or near a fire, for some time, and frequently shaken. Prangé recommends the subacetate of lead (liquid) and olive oil, of each thirty parts; sulphur, fifteen parts.

With regard to ointments, the Helmeric pomade already mentioned is very efficacious. Mercurial ointment, and different compounds of mercury, are also much resorted to, but these are readily absorbed by the skin. Dressings of tobacco have the same disadvantage.

It is generally a good plan to wash the animal well with soft soap or carbonate of potass in warm water, before applying the parasiticide. The latter should be washed off the skin after it has been applied three or four days. If the skin is covered with long thick hair, it is advisable to have this cut off.

The success of the remedy depends very much on the care with which it is applied to every part of the skin.

For house-dogs, and especially those with fine skins and smooth hair, a very excellent and safe remedy is the balsam of Peru, dissolved in alcohol (one of balsam to four of alcohol). This is an effective acaricide, and has not an unpleasant odour.

With regard to the treatment of follicular Scabies, the situation of the demodex renders it almost inaccessible to parasiticidal agents; and the disease it engenders is therefore looked upon as extremely troublesome, and in the majority of cases almost beyond a cure. Often when it is believed to be ex-

tinguished, it reappears in all its virulency in one or two months. Nevertheless, Zürn asserts that he has frequently succeeded with an ointment composed of one part of benzine to four of lard. Weiss recommends the inunction of essence of juniper. Zundel states that the balsam of Peru has often yielded good results when the malady has not been of too long duration: he has employed it dissolved in alcohol (one to thirty); he has likewise used the green ointment of mercury with success, as well as the nitrate of silver ointment.

Hofer speaks highly of an ointment composed of carbolic acid; and Vogel prescribes a solution of caustic potash.

SCABIES IN THE CAT.

The cat is only affected with "sarcoptic Scabies," due to the presence of the *Sarcoptes minor* or *cati* (Fürstenberg). It is a very common disease in some countries, as in Hanover. The parasite is only one-half the size of the sarcoptes of the horse.*

SYMPTOMS.

The head of the cat is the favourite region of the sarcoptes; it first attacks the ears, and afterwards the other parts. Even if placed on any other region of the body, the parasite will make its way to the head, after producing a slight eruption at the place where it was deposited. From the head it extends to the neck, body, and limbs, even to the claws; but this wide extension is not usual, the malady localizing itself for a long time. The matting of the hair, its dulness, and the scratching of the animal, are the first symptoms observed. Then follow scales on the cuticle, shedding of the hair, infiltration

* There are sometimes severe epizoöties of Scabies in the cat species; and in "Animal Plagues" I have described several of the most notable. That which appeared in Westphalia in 1763, and lasted for two years, destroyed nearly all the cats over wide districts. Quite recently, Zundel has witnessed all these animals in a number of communes in Alsace, perish in a short time from Scabies.

and thickening of the skin, and crusts abounding with parasites—living and dead. The conjunctival membrane of the eyes becomes injected, and the eyelids are swollen; the animal is dull, slow in its movements, loses condition, and dies in a state of marasmus, whether the disease be general or limited only to the head.

CONTAGION.

Clinical observations, as well as experiments, have demonstrated the transmissibility of the disease. When transferred to man, the parasite does not produce so much disturbance as to some of the other species, and the duration of the eruption is from five days to three weeks, when it disappears spontaneously. It is very readily communicated to children. It has also been observed to thrive upon the horse, and produce symptoms differing in nothing from the ordinary Scabies of that animal. To the ox and goat it is likewise transmissible, and at times it gives rise to a somewhat intractable form of Scabies. With the other domesticated animals it only causes pruritis for a few days; but it has no effect on the sheep.

In a baker's cat, affected with a psoric eruption, Hering found the ordinary flour-mite.

SANITARY AND CURATIVE MEASURES.

The sanitary and curative measures should be similar to those recommended for the dog. Only it must be remarked that, with regard to the latter, the cat is very sensitive cutaneously, and much care is necessary in selecting and applying a remedy. A weak preparation of creosote is, according to Hering, the most efficient and prompt; but Gerlach asserts that creosote is a very powerful poison to the cat, and if applied to its skin the animal sinks and dies. He recommends a mild decoction of tobacco. A preparation of sulphur, like Helmeric's pomade, should be a good application; but the best and safest is doubtless the tincture of balsam of Peru recommended for lap-dogs.

SCABIES IN THE RABBIT.

The rabbit is also only affected with one variety of Scabies, the "sarcoptic," likewise due to the *Sarcoptes minor.** It commences at the nose, descends towards the lips, and ascends on the forehead, rarely going beyond these regions. The hair falls off, scales appear, and, becoming agglutinated, are changed into grayish crusts, which may attain one-fourth of an inch in thickness; under these the skin is red and infiltrated.

When placed on the human body, the sarcoptes of the rabbit excavates a gallery in the epidermis, particularly if the skin is very fine. Small red points are developed, and sometimes an almost microscopic vesicle, accompanied by a slight itching. These phenomena only persist for two or three days.

The parasite has no effect on the other domesticated animals.

The disease is best treated with topical and repeated applications of soft-soap and sulphur. Tobacco dressings, and those ointments which have lard for their excipient, very often kill the rabbit.

SCABIES IN THE CAMEL.

The camel and dromedary are much affected with Scabies from the presence of the *Sarcoptes dromedarii* (Vallon). It more especially appears in the spring, and shows itself at the flanks, sides of the body, and the neck and tail. The animals are continually rubbing themselves and rolling; they become dull and lose their appetite; vesicles appear on the skin, and these are soon succeeded by a layer of scales. When not interfered with, the skin submits to the changes already indicated, and the animal perishes from emaciation and exhaustion.

The same dressings as for the cow or horse will suffice, and the same sanitary measures are necessary. The Arabs usually

* Mégnin has recently discovered the psoroptes on this creature; and it would also appear to be at times infested with the symbiotes.

tar their dromedaries, in order to preserve them from, or cure them of, the disease.

The parasite is transmissible to mankind; though, according to some authorities, it does not appear to propagate in its new home.*

SCABIES IN POULTRY.

Reynal and Lanquetin first observed Scabies in poultry, due to the *Sarcoptes mutans*. At first the birds did not evince any distinct symptoms, except now and again shaking the head convulsively, and jerking up the feet.

The disease commenced on the feet and head, chiefly around the beak. When the head was affected, there were observed at the base of the crest, which was elsewhere healthy, white spots, with zig-zag or circular lines; these were covered with soft epidermic scales, beneath which the skin was brown and thickened, and in about fourteen days to a month the base of the crest itself was considerably hypertrophied. These alterations extended; under the crusts, which became thicker and more numerous, reddish-brown-coloured nodules arose; the feathers about the crest and beak lost their lustre and colour; their free extremity was distorted, and at last they became rolled up and disappeared in the thick pellicles formed around their roots. The head was then destitute of feathers, the crest enlarged, brown, and wrinkled, and its surface tuberculated and covered with white bran-like flakes; crusts had also formed at the upper part of the neck and beak. With other fowls, the disease commenced at the feet: the earliest phenomenon being the appearance of scales like bran at the roots and on the sides of the toes, which gradually became thick and yellow. In a month or more, the natural scales covering the legs were thrown up by the formation of crusts on their inner surface; the feathers in their vicinity were shed

* "The Itch, and its best remedy, sulphur, abound from one end of Arabia to the other; but the unskilfulness of the Arabs themselves in the application of the mineral often thwarts its effect, or leaves it only partial. This unseemly affection is common among camels, and from them is frequently communicated to men."—*Palgrave.* "Eastern and Central Arabia," vol. ii. page 34.

or buried in crusts, and the skin on the inferior aspect of the toes became cracked ; at length the feet became deformed, through the accumulation of the crusts. In some cases the disease extended from the head towards the neck, and from the feet towards the breast. The first indication of this was the bristling-up and shedding of the feathers in the invaded parts. These crusts presented the greatest analogy to those described for the first time by Boeck, as present in a curious and very rare form of human Scabies at Christiana, Sweden.

When the disease had reached its greatest development in the limbs, it was not unlike the Elephantiasis of mammals.

In the deeper layers of the crusts only were the parasites, their ova, and their *débris* found.

By experiment, it was proved that, contagious among poultry, the disease was also transmissible to the equine and the human species. The *Sarcoptes mutans*, placed beneath a watch-glass on the skin of the arm, caused the development of a vesicular eruption resembling that of ordinary Scabies ; and, deposited on the skin of a horse, it induced a pruriginous affection. In addition to this, the people employed in the poultry yards experienced such severe itching of the hands and arms, that they were persuaded they really had the Itch.

The fowls were treated by rubbing the "pomade d'Helmeric" on the feet and skin ; some were also rubbed with mercurial ointment, liquid benzine mixed with oil or lard ; or corrosive sublimate, one part dissolved in twenty of alcohol.

USE OF THE FLESH AND MILK OF ANIMALS AFFECTED WITH SCABIES AS FOOD.

There is no evidence whatever that the flesh of animals which have been affected with Scabies is injurious as food. Allowance must, of course, be made for its depreciation in nutritive qualities, should the animals have been seriously affected ; and if they were in a state of marasmus, it may, on this account, not be at all fit for consumption.

The same remarks are applicable to the milk of such of those animals as yield this fluid for human consumption.

RINGWORM.

SYNONYMS.—Technical: *Porrigo asbestinea, Tinea tonsurans, Tinea circinatus, Herpes circinatus, Trichomycosis, Tinea tondens.* English: *Ringworm.* French: *Teigne tonsurante, Herpes tonsurante, Dartre tonsurante.* German: *Pilzflechte, Teig-und Borkenflechte, Teiggrind, Teigmaal, Kälberflecke.* Italian: *Empitiggine.* Spanish: *Sarpullido, Paño, Empeine.*

GEOGRAPHICAL DISTRIBUTION.

This parasitic affection of the skin is probably widely distributed, though its prevalence in different regions may vary. Thus, in the Australian colonies it is very common in cattle, but appears to be somewhat rare among horses.

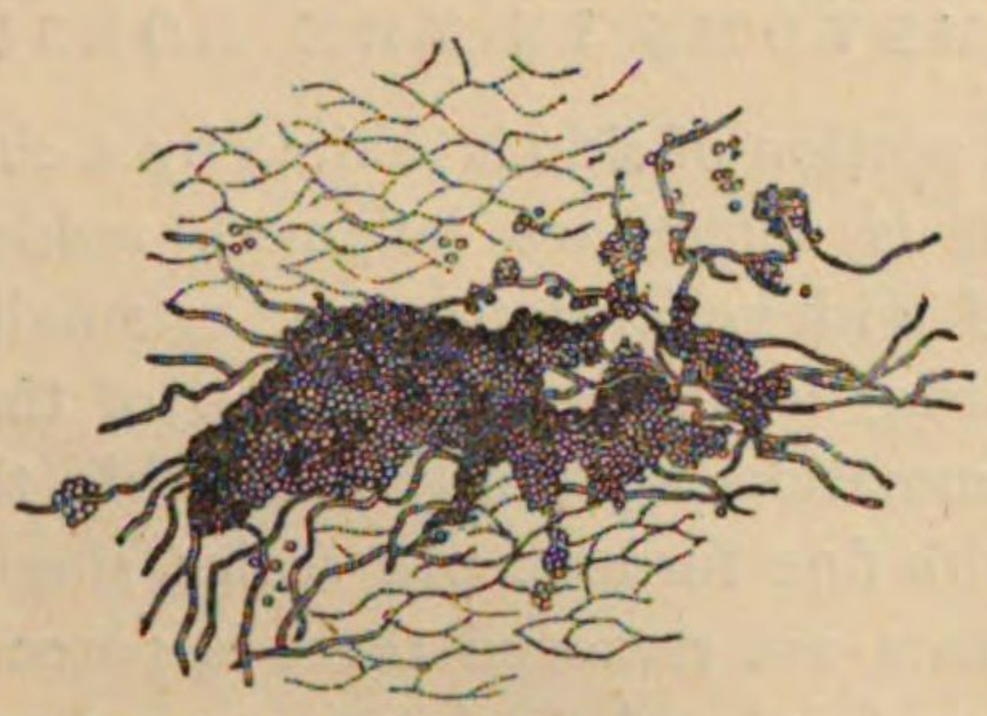
CHARACTER.

"Ringworm" is a contagious affection of the skin, due to a vegetable parasite; it is characterized by certain, though somewhat varied, alterations, but its principal feature is the configuration it offers on the cutaneous surface. The alterations consist in the formation of circular, bald, scaly, or crust-covered patches. The disease is usually chronic, and may at times be even epizoötic. It is readily amenable to treatment when hygiènic conditions are favourable. It affects all the domesticated animals.

NATURE.

The disease, which belongs to the dermatophytic, epiphytic, or vegetable parasite class, and which Tilbury Fox has grouped in the *Tinæ*, is due to the presence of a minute, or rather microscopical, fungus, the *Tricophyton tonsurans* (Malmsten), or *Achorion Lebertii.* This invades the hairs and the epithelial cells of the epidermis, and consists of spores and filaments. The first are most numerous, and are round, nucleated, often-

times constricted, and exhibit a great uniformity in size in the same subject, being always very abundant in the root of the hair. The filaments are few in number; they are articulated, somewhat undulated, and contain granules (Fox). The fungus, by invading the root and shaft of the hairs, produces such a change in them that they lose their suppleness, break off irregularly, and close to the skin, leaving more or less cir-



Elements of *Tricophyton tonsurans.*

cular bare patches, which have obtained for the malady the designation of *Lichen squamosus* or *circumscriptus*, or *Alopecia circumscripta.* The surface of the skin is also progressively involved, and fine micaceous scales and powder appear to close up the orifices of the hair-follicles and surround each hair, which becomes of a lighter colour, splits, twists, and breaks. The skin at the same time becomes irritated and altered. The spores are smaller in the horse than in mankind. It is somewhat remarkable that, in artificial infection, even when the spores have been deposited in a thin line, the tendency to assume the circular form is as strong as in natural infection.

CAUSES.

The cause of the disease is the spores of the tricophyton, which may be transferred from a diseased to a healthy animal, either accidentally or purposely. It more especially attacks young animals, although age does not offer exemption; and it is most frequently observed during cold damp seasons, and in uncomfortable, dirty stables; insufficient food and inattention to the cleanliness of the skin also appear to favour its invasion and extension. It is transmissible not only from one animal

to another of the same species, but to other species. In this way horses, cattle, dogs, and people * have been infected. From the ox it is readily transferred to man, and *vice versâ*, as well as from the ox to the horse and dog; though it is less permanent with these.

SYMPTOMS IN THE HORSE.

The diseased portion of skin is limited by a circular margin, within which it is sometimes inflamed, reddened, slightly swollen, covered with vesicles, papules, or small pustules, or the crusts resulting from the desiccation of these; at other times the inflammation is scarcely noticeable, the skin being only covered with fine furfuraceous scales, singly or in mass. When these crusts are removed there is perceived, in some cases, a very superficial, red, discharging sore; or the skin may yet be covered by a thin epithelial layer more or less altered. These crusts are renewed, and the affected places are generally the seat of a variable degree of pruritis.

In the "tonsurant" form of the disease, the altered surface always forms a complete circle; sometimes the crust covering it is sharply defined around its margin, and stands above the surface, measuring from the size of a sixpence to that of a florin, or even a five-shilling piece; it is gray or brown in colour, may be slightly or firmly adherent, and consistent or powdery.

In the "circinated" form, the centre of the patch is healthy, the diseased ring surrounding it, and which is vesicular or papular, being more or less wide; it is merely a form of the other, and increases in size by centrifugal growth.

It is rare that we have not more than one patch of Tinea; usually there are a number, but if only a few at first, they soon multiply, and then we find them in different stages of development and extension. They are commonly most frequent on the upper and lateral parts of the body, though

* I have given a good example of its transmission from a horse to a man in the "Veterinarian" for May, 1872 (page 287).

any part may be attacked; and grooming tends to diffuse the spores.

SYMPTOMS IN THE OX.

The symptoms in the ox are similar to those in the horse. There are observed patches, at first small, round, well defined, slightly raised, and covered with gray or whitish pellicles and crusts. These patches extend from their circumference, and gradually attain about the same dimensions as in the horse, frequently joining each other, and producing pruriginous manifestations. They are more particularly located on the head and neck; though the other regions of the body, except the lower parts of the limbs, are not exempted. The crust gradually accumulates in the diseased parts, especially in dark-haired animals, and may become several lines in thickness; the dark hairs break off close to the skin, but in white-coated cattle this does not occur so frequently. At first the crust adheres closely, but in time it is detached from the central point by a purulent fluid, and at last only remains attached by its periphery. The hair roots are destroyed, and when the inflammation in the corium has ceased, the crusts and shaft of the hairs are thrown off in considerable quantity. In this way recovery is effected in certain points, without medical intervention,—though it is not at all unusual, and particularly in young animals, to see the disease appear in other parts as it disappears in these.

SYMPTOMS IN THE DOG.

Gerlach was the first to describe Ringworm in the dog, and to point out its analogy to that of cattle. It varies a little, according to the breed, and the structure and colour of the skin and hair. In certain points of the skin there are gradually developed circumscribed layers of scales of variable thickness, which insensibly extend towards their margin; the hairs soon become broken and the roots detached,—so that in

raising the crust we can see these at its lower surface. According to the nature of the skin, the surface below the crust may be dry, moist, destitute of hair, or studded with short bristly fragments, and perhaps thickened. The circular form is generally observed; though this is frequently modified through the animal biting, rubbing, and scratching itself, and thus dispersing the spores. The shedding of the crusts is followed by desquamation: they are formed by epidermic cells, dried exudat, and the fungus—the latter offering the same characteristics as the *Tricophyton tonsurans*, though the spores are a little larger than those observed in the horse.

COURSE AND TERMINATIONS.

In the horse and cow the disease is not difficult to cure; and if allowed to take its course, in many cases it may disappear spontaneously. Its duration is from a fortnight to several months. With animals well fed and properly kept, and especially when allowed to live in the open air, a spontaneous recovery is not at all unusual, particularly among old animals. Then the inflammation and morbid secretions cease,—the crusts or scales are shed, and in a short time the new hair appears, darker and more lustrous than before. With young animals, the disease is generally more persistent; and when bad feeding and imperfect hygiène are combined with debility, and perhaps Scabies or Pityriasis, then it may become very obstinate, and lead to marasmus. A spontaneous recovery has not been observed in the dog, I believe.

PATHOLOGICAL ANATOMY.

This has been already described, when speaking of the nature of the disease.

DIAGNOSIS.

The circular form of the diseased patches, the shining, gray, scaly or powdery crusts, their circumferential extension, and, finally, the presence of the fungus, distinguish this from all other cutaneous diseases.

CONTAGIUM.

This may be designated a "fixed" contagium.

VITALITY OF THE PARASITE.

The tricophyton appears to be endowed with a considerable degree of vital tenacity, as it has germinated when kept for more than six months. It has been successfully inoculated after it had been removed, two, three, and six months from the skin of a diseased animal. It is readily destroyed, however, by a high temperature and various agents.

INFECTION.

As has been mentioned, the parasite is transmissible within certain degrees. Thus the tricophyton of the horse is readily conveyed to other horses and to mankind, but does not appear to be so easily transmitted to other animals. That of the ox appears to be the most accommodating, for Ringworm in this animal spreads quickly to other oxen; its transmission to horses and dogs is only marked by an eruption which terminates in a rapid and spontaneous recovery. Transmitted to mankind, it produces on the arms and legs an annular eruption, the spores from which, when conveyed again to the ox, are capable of germinating and giving rise to the same phenomena. It is not transmissible to sheep or pigs.

The Ringworm of the dog is transmissible to other dogs, the horse, and mankind. Experiments with the ox have yielded negative results.

MODE OF INFECTION.

Infection occurs generally through implantation of the spores of the tricophyton into the skin of a healthy animal, either by contact with the diseased, or mediately through brushes, wisps, the air, &c.

MODE OF ACCESS.

When the spores have arrived at the surface of the skin, they lodge themselves around and in the hair-follicles, and

becoming developed, extend beneath the epithelial scales, and into the bulb and shaft of the hair.

INCUBATION.

The period of incubation is from eight to fourteen days.

EXTENSION.

The disease extends somewhat rapidly among young horses, and is sometimes troublesome among army remounts, especially in winter; it is still more active among cattle. It is extended through actual contact, and by grooming implements which harbour the germs of the tricophyton.

MORTALITY AND LOSS.

The disease is not of much moment in a sanitary point of view, and is much less to be feared than the same malady in man. It is chiefly objectionable from the readiness with which it can be transmitted, the irritation it causes, and the unsightly appearance of the diseased skin.

IMMUNITY.

Old animals are much less susceptible to the disease than young ones, and an animal may have repeated attacks.

SANITARY MEASURES.

These are very simple, and consist in separating the diseased from the healthy, and not allowing the latter to be groomed with brushes or other articles, or covered with blankets, which have been used on the diseased. The stalls should also be limewashed, and forage or bedding which has been in contact with infected animals should not be used for those which are healthy and susceptible.

Harness should be thoroughly cleansed with warm water, and dressed with paraffine. Clothing should be steeped in a strong alkaline solution, or boiled for a short time.

CURATIVE MEASURES.

Attention to hygiène is the principal object. Good food and cleanliness must be insisted upon. Recovery will be greatly accelerated by topical remedies. The scales should be removed by washing the parts with soap and water, or hypo-sulphite of soda lotion; or, if the crusts are very adherent, dressing them with oil, and afterwards washing. The diseased places may then be treated with a weak solution of corrosive sublimate, carbolic acid, tincture of cantharides or iodine, oil of tar, chloride of zinc, paraffine; or mercurial, iodine, or oxide of zinc ointment. This cures the disease very speedily, and promptly checks its extension.

If there is emacation, tonics may be necessary.

HONEYCOMB RINGWORM.

SYNONYMS—Technical: *Favus, Tinea favosa, Porrigo favosa, Porrigo larvalis, lupinosa, or scutulata.*

GEOGRAPHICAL DISTRIBUTION.

We know but little of the extent of this peculiar parasitic skin disease among the lower animals, as it does not appear to be very frequent among them, and may often, when present, be confounded with others. It has been observed in America and on the continent of Europe affecting animals—mice, rats, cats, and dogs—and has been transmitted to the human species from some of these. I have seen it affecting rabbits, and it has been reported in horses and cattle.

CHARACTER.

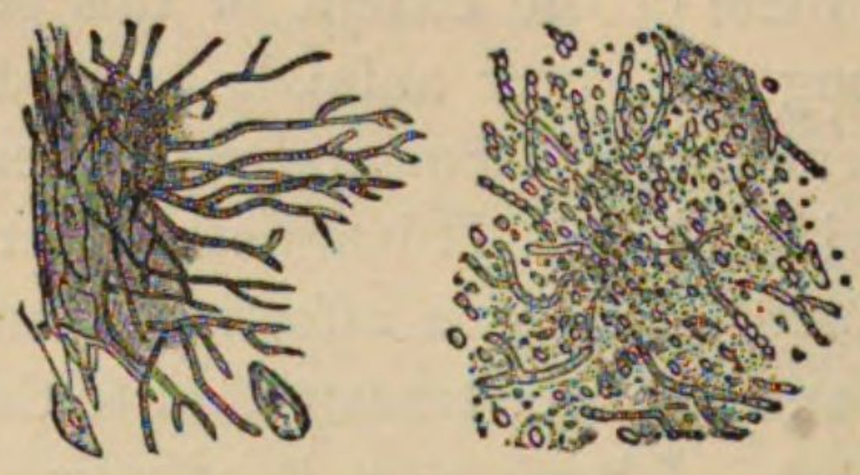
This cryptogamic or epiphytic form of disease is characterized by the presence of a yellowish or sulphur-coloured cupped crust on the skin in various parts of the body, and which extends more or less rapidly like ordinary Ringworm, though

not in the same circular patches. These crusts or "favi" are accompanied by a trifling degree of inflammation of the skin; they may remain isolated (*Favus dispersus*), or coalesce and form a honeycomb mass (*Favus disseminatus*).

NATURE.

The disease depends upon the presence of a cryptogamic fungus named the *Achorion Schönleinii*, after Schönlein, who first suggested that the yellow Favus-crusts were due to a vegetable production. The primary seat of the parasite is in the hair-follicle, outside the layer of epithelium which covers the root of the hair. By using a concentrated solution of *liquor potassæ* to make the parts transparent, the fungus may be observed, by means of the microscope, in the follicle round the hair, at the place where it passes through the epidermis.

It is important to remember that at first there is, at the point where the Favus is about to form, only an increased secretion of epidermis; and sometimes the under surface of the Favus is coated by the cuticle, which separates it from the compressed and attenuated derma. As it increases in size and becomes more prominent, the epidermic covering is ruptured. Each Favus-crust is also enveloped in a capsule of amorphous structure, within which is enclosed the true Favus material.



Elements of *Achorion Schönleinii*. (After Bennett.)

The Favus consists entirely of fungus elements—mycelial threads, spores or conidia, the receptacles of the *Achorion*, together with a finely granular amorphous layer which forms the external coat of the Favus, and is the representative of the "stroma" which often accompanies the mycelium of fungi.

When a little of the Favus matter is broken up and examined microscopically, after being acted upon by solution of potash, it is seen to consist of numerous little oval or round spores, about one 3000th part of an inch in diameter, the largest being provided with a double envelope, and are free, jointed, or constricted; a number of cells joined end to end to form simple or jointed, and more or less tortuous, branching tubes, developed from the spores; generally containing granules and sporules in their interior, and averaging one 8000th part of an inch in diameter; and short, straight sporophores or fibres, with sometimes four spores at their extremity. The stroma is composed of free, but very minute cells. In the Favus, another and distinct fungus—the *Puccinia favi*—is at times observed, and is readily recognized; one extremity—the body—is rounded, and composed of two cells of unequal size, a superior and inferior; the other extremity is prolonged into a jointed stem or trunk.

The odour of the parasite is peculiar, and is said to resemble that of mice, cats' urine, &c.

It has been conjectured that the Favus of this form of Ringworm and that of *Tinea tonsurans* are essentially one fungus: the variation in its growth being due to constitutional differences of individuals, as well as with regard to the humidity, exudation, soil, or temperature under which the development takes place. If such were the case, we should expect to find the *Achorion* produce Tinea tonsurans, and the *Trichophyton*, Favus; but I am not aware that such has ever been positively ascertained, though common Ringworm is far from being a rare disease among animals.

CAUSES.

The cause of Honeycomb Ringworm is the *Achorion Schönleinii*. The predisposing causes are possibly neglect of hygiène, and general unhealthiness. Youth is also favourable, as well as a certain condition of the skin, associated with humidity.

SYMPTOMS.

The disease may appear in any part of the body of animals, according to the point of infection. It affects mice generally, but cats which are infected from them usually have it first at the base of the claws of the fore feet. In the dog it has been seen on the head, and it usually affects the head in the human species. In the rabbits I saw diseased, the parasite was at first on the nose and face, but gradually extended towards the shoulders.

The disease commences with an increased proliferation of epidermic cells, and soon after a little white sub-epidermic speck becomes visible, which quickly develops into a Favus-cup —the developed fungus. As the elements of the latter grow, they collect about and in the hair-follicle, each Favus-cup being pierced near its centre by a hair. At first the Favi are merely yellow specks.

When the malady is of some duration, it is characterized by one or more masses of irregular crusts, more or less fissured, of a somewhat pitchy consistency, offering, when broken, a fine granular structure, and having a bright-yellow colour, like sulphur. They affect a remarkable disposition: their contour, sometimes very circular, at other times more or less notched, forms a slight prominence that rises a little above the surrounding skin; their centre is, on the contrary, to a greater or less degree concave: a conformation that gives the crust the aspect of a cup.

These capsules, or *favi*, are more or less numerous, and more or less extensive. At the free surface of the crusts there are often found dry bristly hairs, that appear to pass through the entire thickness of the Favus mass, and are easily pulled out. At a later period, these hairs are shed from the follicles —not broken off, or sharply cut away close to the crusts, as in *Tinea tonsurans*.

If the crusts are carefully removed, the skin beneath is observed to be thin and depressed, and looking as if atrophied by compression: but smooth, not ulcerated, and either quite dry, or moist from serous exudation; sometimes it is pale and

anæmic; but more frequently red, irritated, and sufficiently transparent to show some very fine blood-vessels. Around the margin of the crust the skin is sensibly inflamed, red, thickened, and rises into a somewhat salient prominence. In the dog there is much pruritis: a symptom which is rarely noticeable in the cat; otherwise, it does not appear to exercise any prejudicial effect on the general health.*

Another form is that in which the plant is found in depres-

* Some excellent and instructive experiments on the transmission of this disease between different species of animals, were made by Professor St. Cyr, of the Lyons Veterinary School, a few years ago; and the memoir containing an account of them was translated by me, and appeared in the *Veterinarian* for 1871. The parasite could be readily sown and cultivated by him, provided proper subjects and precautions were adopted. The animals were young, and the part selected for growing the fungus was gently blistered; the Favus dust was then sprinkled over the humid cuticle, and covered with a piece of diachylon plaster, to maintain the surface in a state of humidity favourable to the germination of the parasite. In forty-eight hours the plaster was removed, and it was found that the sown surface, which was on exposure a little moist, soon dried; the epidermis was regenerated: but instead of forming a continuous layer, smooth and adherent, it became detached, and came away for several days in the form of different-sized furfuraceous scales. From the eighth to the twelfth day began to be distinguished, on the surface where the Favus dust had been deposited, some little tubercles about the size of a pin-head, grain of millet, or at the most, a small pea, slightly salient, but hard to the touch, and of a grayish colour. At first hemispherical, these tubercles soon became depressed in their centre, their borders becoming elevated, and giving them a cupuliform aspect. These were veritable Favi, traversed by a little tuft of bristly hair, only differing from the human Favi by their remaining a long time of a dull gray colour.

If this primary Favus-crust be removed, it is reproduced very rapidly, sometimes by the following morning; this new crust very distinctly exhibits the sulphur-yellow hue. Otherwise, in the primary crust, as in that which succeeds it, there is found, on microscopical examination, the same elements observed in the ordinary Tinea crusts.

With time, these Favi increase; others are developed in their vicinity; the nearest soon coalesce by their margins, and then become deformed; at times their central depression is obliterated by the incessant accumulation of new cryptogamic elements, and the cupuliform aspect disappears; but it is very rare indeed that it is not observed sharply defined on the borders of the affected part.

sions on the surface of the skin, forming the yellow honeycomb-like masses which gave the name "favus" to the disease, and which, from their being frequently buckler-shaped, suggested the term "scutulata." A cuticular elevation is seen, beneath which is a small Favus. Generally there is no pus or fluid of any kind; the fungus grows, and the cuticle above it, supposing it to have become forcibly detached, finally separates, leaving the Favus exposed.*

SYMPTOMS IN THE HORSE.

Mégnin, of the French cavalry, and Goyau, of the St. Cyr Military School, have described some cases of *Tinea dispersus* (or, as the former designates it, *Tinea diffusa*) in the horse in 1863. The symptoms were the appearance of little yellowish, rough, dry incrustations, not exceeding a hempseed in volume, and disseminated in a somewhat close manner over the body: commencing with the upper part of the trunk, and descending on the shoulders, sides, flanks, and thighs. Pruritis was usually the first indication of the presence of the parasite, and it continued during the existence of the disease: being most severe at night, and causing the animal to bite and rub itself until its sides and flanks were torn and covered with blood. On the croup and towards the withers, the parasite was found most perfect. The hairs were not broken or altered, as in Tinea tonsurans: the bulb only being withered, and the cells composing it separated from each other like a brush.

* A third form of the disease in man is that in which the fungus attacks the nails, and occurs for the most part in those who have been for a long time affected with Favus of the hair-follicles, the fungus taking root and germinating beneath the nail. After the spores have commenced to germinate between the superficial and deep epidermic layers, the nail becomes thickened over the affected part, and its colour gradually yellower, owing to the Favus material shining through it. As the fungus increases in growth, it gradually presses on the nail, rendering its longitudinal striæ very evident, and ultimately leading to the formation of fissures in it. As the pressure on the nail increases, its substance becomes thinner, and at last it is perforated, when a Favus-cup makes its appearance externally, though it is more or less deformed.

SYMPTOMS IN POULTRY.

Müller and Gerlach were the first to observe this disease in poultry, and it appears to have only become known since the introduction of Cochin-China fowls. The eruption commences close to the comb and wattles, extends thence to the neck and back, and may, if the animal survives, invade the entire body. The diseased parts are covered with dry, whitish-yellow, irregular crusts, depressed in the centre. These crusts envelop the feathers where they are inserted into the skin, pass into the follicle and the cavity of the feathers: which become dry, easily pulled out, and bristling. The skin is thickened between the crusts, and eroded beneath them. The disease at first makes slow progress; but when it has invaded the neck and trunk, it then runs its course rapidly, and the poultry become emaciated and perish of Phthisis. When the crusts are examined microscopically, besides the epidermic scales and dried exudat, there are observed layers of the *Achorion:* which differs slightly from that of man, in having fewer filaments and a preponderance of spores closely packed together.

COURSE AND TERMINATIONS.

The disease is at first slow in its progress; but when a large surface of the body has been occupied by the parasite, the irritation and debility generally bring the animals affected with it into a low state, which may end in emaciation and death. In some cases recovery takes place spontaneously.

DIAGNOSIS.

The peculiar shape, colour, and mode of growth of the fungus, should distinguish it from all other affections of the skin.

CONTAGIUM.

This is the *Achorion Schönleinii.*

VITALITY OF THE PARASITE.

We have no evidence to offer with regard to the vitality of the parasite in animals, but it is probable that it is more tenacious than that of the *Tricophyton*. The sporules have been developed on the cut surface of an apple, and in animal fluids with which sugar had been mixed, but not in those to which sugar had not been added. St. Cyr observed that in an experimental case which had been most successfully inoculated, when the animal was subsequently affected with Scabies, the *Achorion* quickly perished.

INFECTION.

The disease is transmissible from the human species to animals, and *vice versâ*. The cat, when diseased, frequently infects children, and that animal in turn is infected by mice.

Mice have also directly infected people.* We have no evidence to prove that the malady has ever been so communicated to the horse. It has been successfully transplanted from man to animals.

St. Cyr's conclusions, the result of his experiments, are as follows:—1. Animals, and particularly the dog, cat, and mouse, are capable of contracting Tinea favosa. 2. They may contract it by direct infection from animal to animal, and also, especially the cat, receive it through their relations with diseased children. 3. The mouse being liable to the disease, it is very probable that this little rodent very frequently transmits it to cats, as these are very fond of playing with their living captives. 4. Young cats affected with the disease may, in their turn, convey it to children, who amuse themselves by fondling these creatures.

With regard to the Favus of poultry, attempts to transmit it to horses, cattle, and dogs have only yielded negative results; in mankind, however, they have been successful.

The *Achorion* has been successfully cultivated on trees.

* Of all animals, rats and mice appear to be most frequently affected with this disease.

MODE OF INFECTION.

This is the same as with Tinea tonsurans ; though infection is not so certain as in that disease.

MODE OF ACCESS.

This is also the same as in Tinea tonsurans.

INCUBATION.

This is probably from eight to twelve days, when the skin is in a favourable condition.

EXTENSION.

This takes place in a similar manner to ordinary Ringworm.

MORTALITY AND LOSS.

The disease is readily cured, and does not at all offer the serious character in animals to that it does in mankind.

IMMUNITY.

Adult and old age appear to confer immunity to a great extent. St. Cyr's experiments on adult animals yielded negative results, while all those on young creatures were successful. One attack does not afford exemption from another.

SANITARY MEASURES.

The sanitary measures must be similar to those prescribed for ordinary Ringworm. Isolation, cleanliness, and disinfection, are to be carried out in the same manner. Kennels, utensils, stables, and hen-roosts should be thoroughly cleansed. When mice or other vermin are discovered to be the cause, these must be caught and buried. Cats should not be allowed to hunt for them.

CURATIVE MEASURES.

As we have already remarked, this disease is much more amenable to curative treatment in animals than in man. This

may be due to the difference in the organization of the skin; as in the dog, and more particularly in the cat, it is thin, fine, and very supple, and is furnished with numerous hairs, which are delicate, and not deeply implanted in its texture. The human scalp, on the contrary, which is the usual seat of Favus, is thick, and the bulbs of the hair are inserted much deeper; so that, as the spores of the fungus insinuate themselves to the very bottom of the follicle, on the internal face of which they form an adherent layer, it is obvious that it is much more difficult to reach the parasite. When the disease appears elsewhere than on the scalp of man, it is much more easily cured.

The crusts should be removed by alkaline washes—hypo-sulphite of soda—or raising them by means of a spatula or the blunt extremity of curved scissors, taking care not to make the part bleed. When the skin has been cleaned in this manner as much as possible, a concentrated solution of corrosive sublimate (one to five of the sublimate to fifty of distilled water) should be applied every day. After the first application, the Favus-crusts sometimes have a tendency to be reproduced, and the cryptogamic elements to multiply. In such a case, it is necessary again to remove the crusts, as at first. Five or six dressings are usually sufficient. At times, however, and especially when the disease is seated at the base of the claw (as in the cat), they must be continued for a longer period. Under the influence of this treatment, the skin, which is depressed on its surface, is not long before it regains its normal vitality and thickness. During the first two or three days, a new crust forms; but this has not the sulphur-yellow colour of the primary crust, and if examined with the microscope, there are no longer to be found traces of the parasite, but only numerous epithelial elements. Finally, this kind of crust falls off, leaving the skin hairless, but every-where level, smooth, and supple. Then the hair begins to grow, and in a variable period—generally about three months—it is difficult to discover the part that has been affected.

An ointment composed of one part nitrate of silver to 100 parts of lard, has also been successfully employed.

Mercurial ointment, tar ointment, and sulphate of mercury ointment have also been beneficially used. In some cases it may be necessary to remove the hair.

In poultry the malady is very obstinate, and treatment can only be undertaken with a prospect of success when it is confined to the head; when the body begins to be invaded, the fowls nearly always die from exhaustion. When the crest and wattles only are involved, sulphur ointment or red precipitate are useful. When the disease is more extensive, the corrosive sublimate lotion, or the carbolic acid ointment or lotion, must be resorted to.

TRICHINIASIS OR TRICHINOSIS.

GEOGRAPHICAL DISTRIBUTION.

THE geographical distribution of this disease is not yet well ascertained, but there are several reasons for believing that it is more universal than is generally supposed. In this country its existence has been accidentally discovered in the flesh of pigs not at all suspected. It has often been witnessed in the human species in North Germany, especially in Saxony and Prussia, in Switzerland and in France, and it appeared as an epidemy in Cumberland in 1871. It may exist widely in this country for anything known to the contrary; as the parasite has not been much sought for in the lower animals, and the diseases of pigs are but little studied.

Outbreaks have been noted in America (United States),—and one occurred in the commencement of the present year (1874).

CHARACTER.

Trichinosis is a diseased condition produced by the presence of a parasite or entozoön—the *Trichina spiralis*—which originally infests a number of animals: such as the rat, mouse, hamster, hedgehog, polecat, martin, fox, mole, cat, jackdaw, crow, vulture, poultry and other birds, and the pig; the trichinæ, are transmissible to other creatures which devour their flesh, and, most important of all, to mankind, and these may in their turn extend the malady. The disease is marked by a group of symptoms, but chiefly those indicative of muscular and intestinal irritation, the development of which depends upon certain changes in form and location the parasite undergoes in the body of its host: the malady subsiding when the changes are

completed. Herbivorous animals may be said to be exempted from Trichinosis, in consequence of the nature of their food.*

NATURE.

The malady is evidently parasitic. The *Trichina spiralis* may be described as a creature of microscopical dimensions, having the body nearly straight, the neck fine and slightly marked with transverse lines, and the middle portion of the intestine surrounded by large cells. The female is viviparous, and measures one line and a-half in length; the male only measures three-fourths of a line. In its imperfect state the body is capillary, the head unarmed, and the mouth circular; the anus is at the end of the body, the caudal extremity being rounded and obtuse, and garnished in the mature male with two conical papillæ which limit the genital orifices that open into the anus. The genital orifices of the female are situated at the neck,—the uterus and ovaries are single. The other organs are rudimentary, except the digestive tube, the length of which is from one-third to half-a-line.

In its completely developed state, it inhabits the small intestine of man and many of the mammalia, as well as some birds and other creatures.

Incompletely developed, it is rolled up in a spiral form and contained in a calcareous capsule; in this condition it occupies the muscles of the animals it infests. This is the condition which offers the greatest interest to the veterinarian and physician.

CAUSES.

The cause of "trichinosis" is the presence of the parasite just mentioned, which, in undergoing a change of form and

* Fuchs and Pagenstecher gave a calf a large quantity of infested flesh, and in nineteen days found a great number of fecundated trichinæ in the intestines, and a certain number in the muscles, where they had begun to assume their spiral form. Fuchs states that he has observed enkysted trichinæ in the muscles of the ox and horse; but Virchow believes there is a confusion of species as regards the parasites. He, Leuckart, and Mosler have observed trichinæ in the intestines of these animals, but never in the muscles.

migrating to another part of the body, produces more or less marked symptoms of illness in the bearer. The comparative pathologist and helminthologist are interested in this entozoön in every phase of its development, as it affects all creatures; but the veterinarian and sanitarian are chiefly concerned with its presence in the pig and human being. We shall, therefore, mainly confine our remarks to the disease in the pig, and only incidentally notice its symptoms and effects in mankind.

But we may remark, that the malady can be produced in all the domesticated mammals by giving them flesh infested with enkysted trichinæ; though, among these animals, what has been called the "spontaneous" or natural development of Trichinosis has only been observed in the pig.

We do not know the real origin of the trichina in this animal. At one time it was imagined that the parasite was derived from an annelid observed infesting the beet-root; at another time, that it was due to a nematoid developed in the earth-worm; and, again, that it sprang from an annelid infecting the mole. But these parasites have nothing whatever in common with the trichinæ, and the results furnished by direct experimentation prove this to be the case. Neither does it appear possible to decide how or when the malady was first produced: whether rats or pigs were first attacked, and in their turn infected others; or if the trichinæ were carried into western countries by the brown or Surmulot rat in the last century, or by high-bred pigs of American or Asiatic origin imported into these regions.

It is certain, from isolated outbreaks of Trichinosis occurring here and there in mankind, that centres of these infecting agents do exist, whence, under favourable conditions, the disease may be propagated in different directions.

It is not improbable that rats are, in certain localities, infested with these trichinæ, and that the pigs, in devouring these creatures, also became infested.* Röll's investigations,

* Gerlach, the eminent Prussian veterinarian, was, I believe, the first to discover trichinæ in the rat; he noted that they always appeared to be a long time enkysted. Leisering has found whole colonies of rats infested with them in the Zoological Gardens and knackers' yards of Dresden.

carried on for several years previous to 1865 (Zenker, in 1860, first positively ascertained that the human species could be infected with trichinæ), were unsuccessful in discovering the entozoa in pigs slaughtered at Vienna; the flesh of about one hundred and fifty of these creatures, carefully examined, offered no traces of them. After that date he commenced to examine the flesh of rats, and was not long in discovering two localities in the vicinity of Vienna, and three in Moravia, in which these animals were highly infected; soon after he observed a pig, belonging to an establishment in one of the two localities near Vienna, affected with Trichinosis. From his researches he arrived at the following conclusions:—1. That in the localities where, up to the present time, no cases of Trichinosis in man had been noted, this affection may exist among animals, and even in the pig; 2. That in these places it is easier to discover the existence of trichinous centres in examining the rats than the pigs, for in a given number of rats in an infected locality there will be found more diseased than in the same number of pigs (in forty-seven rats found in one place, seven were affected, while in eighty-three pigs in the same locality only one was trichinosed); 3. That very probably the mode of preparation pork usually undergoes, kills the trichinæ that may be present in it, and thus averts danger.

With regard to the per-centage of infested pigs, it may be stated that in Brunswick, Saxony, Schultze only discovered one in fifteen hundred pigs examined in two years; in Hanover, eleven were found in twenty-five thousand; in the

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The veterinarians, Franck of Munich, Adam of Augsburg, Röll of Vienna, and others, have also found them in rats from the last-named places, and Franck has in addition found them in slaughter-house rats. Fuchs for a long time examined a large number of rats at Heidelberg without finding any flesh-worms, but at length he was successful in those from the vicinity of the University dissecting-room; these, however, there is every reason to believe, had obtained them from the flesh of the subjects that had served for his and Pagenstecher's experiments. These two professors had thus unintentionally domiciled the helminth in that locality.

It is probable that the rats are primarily infested, and transmit the parasites to their own species, generation after generation; as it is well known they devour each other at times.

duchy of Brunswick, sixteen in fourteen thousand; and at Blankenberg, where Trichinosis was epidemic among the human population, there were four found in seven hundred.

The disease may, therefore, be attributed, in the pig, to eating the bodies of creatures already infested with trichinæ,—such as the remains of other pigs, the fæces of diseased persons, and rats, mice, and perhaps also cats. These may likewise become infected in the same way as the pig. The disease is generally produced in the human species by the ingestion of the improperly or uncooked flesh of trichinosed pigs.

SYMPTOMS.

The symptoms of illness are due to the migration of the immature trichinæ from the intestines to the muscular system, or their development in the alimentary tract.* When com-

* The parasites exist in three conditions in the animal body—as intestinal, embryonic, and muscular trichinæ. During the period of their genital activity, they inhabit the intestines of a number of mammals. Thence their embryos wander to different parts of the muscular system of the creature so infested, and there they continue their development, become at length enkysted, and then remain perfectly stationary. In order to arrive at a state of maturity, these immature or muscular trichinæ must submit to a passive migration, and be conveyed into the intestines of another host, which, of course, occurs when the animal swallows them with its food—the trichinosed flesh. If the muscular trichinæ, at a certain stage of evolution, reach the intestines of a suitable animal, they attain their full development in a few days (about two), and commence to breed. Towards the fourth day embryos are already found at the extremity of the vagina, and about the fifth day they have begun to be extruded from the female, appearing as fine hairs. But the transformation of the muscular into the intestinal trichinæ cannot take place unless the former have attained a certain degree of development at the moment of migration,—so that eating flesh in which the trichinæ swarm, if they chance to be in this rudimentary state, does not produce any ill effects.

The hatching of the ova and embryos lasts about four weeks, and it has been estimated that a single female may produce from one to two thousand. There are about ten females to every male. The intestinal trichinæ are most numerous, and especially during the first three weeks; towards the fourth week they diminish in numbers, although from the sixth to the eighth week some may yet be discovered in the alimentary canal. They are usually found lying immediately on the mucous membrane, and with a

pletely enkysted in the muscles, they apparently cause no further disturbance.

It must be noted, however, that in the lower animals the

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little practice they may be distinguished by the naked eye, appearing as white capillary bodies about a line in length. The microscope is, nevertheless, required to distinguish their presence with certainty. The intestinal trichinæ are ejected, towards the termination of their existence, with the fæces; and in animals attacked with Diarrhœa they are previously found in considerable numbers in the gluteal muscles sometimes: though in such cases they have not immigrated so largely. It is not yet known whether the intestinal trichinæ rejected with the fæces retain their infective power if introduced into other bodies. Leuckart, Mosler, and Gerlach have decided the question in the affirmative; but the experiments of Pagenstecher, Fuchs, and Kuhn, as well as those undertaken by Röll, consisting in making animals swallow intestinal mucus containing these parasites, have only yielded negative results. One or two days after the death of the animals, the trichinæ were also found to be dead.

It is only on rare occasions that the embryos are found in a migratory condition in the intestinal mucus; though their presence is frequently noted in the thorax and abdominal cavity, as well as in the pericardium and mesentery, where they arrive after passing through the intestinal walls to reach the muscles. It is most probable that they travel in the connective tissue, their transport by the blood occurring very rarely, if at all. Such, at any rate, is Virchow's opinion; but Fiedler has given direct proofs of their conveyance by the circulation, having several times found them in blood clots from the right auricle and ventricle of the heart.

They appear to penetrate the intestinal wall and fall into the peritoneal sac, and are earliest discovered in the muscles immediately enclosing the abdominal cavity. It would seem that they are not immediately enkysted, but wander about for a certain time, unless their course is interrupted by tendons or tendinous intersections through which they cannot travel; in these situations their kysts are usually found in greatest numbers.

A short time after leaving the intestines (about twelve to fourteen days after infection), the trichinæ are found in the muscles,—though it is rather difficult to distinguish them at this period, because of their softness and small dimensions; they are observed to be extended in the interior of the muscular fibrillæ. Five or six days later they begin to curve themselves, and finally become rolled up in the peculiar spiral manner to which they owe their distinctive name. During this period, the muscular fibrillæ in which the embryos have embedded themselves undergo striking alterations. In the immediate vicinity of the trichinæ, the longitudinal and transverse striæ disappear; the contents of the fibrillæ become broken up into fine molecules;

symptoms vary in intensity and kind to a wonderful extent: for though nearly all the warm-blooded creatures experimented upon were capable of harbouring the entozoa, yet there are in-

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while the muscular nuclei are considerably increased. At these points the fibrillæ are distended; the capillaries are injected; the muscular connective tissue is infiltrated with serum; and around the worm, which grows and becomes more closely rolled up, is formed a cellular areola,—newly-formed cells and nuclei are regularly disposed around it, and more densely packed as the sarcolemma becomes thickened. At a later period —about the fifth week,—the cells are very closely laid together towards the middle of the tube; so that, at the commencement, the parts adjacent to the trichinæ are slightly distinguished from the remainder of the contents towards the two poles,—they gradually become thickened and transformed into a membrane that forms a capsule around the entozoön. A period of two months after infection usually elapses before these different modifications are brought about; the trichinæ perform but trifling movements in the interior of the muscular fibrillæ in which they have lodged themselves, and at whose expense they are nourished. They grow and attain a more advanced development in the capsule formed around them; this capsule shrinks a little, and the poles become rounded, until it finally assumes an oval, spherical, or citron-shape. In about a year flat globules are deposited at the poles of the capsule; and still later both ends are encrusted with calcareous matter, which gradually invades the whole structure. This is mainly the description of the *Trichina spiralis* as given by Virchow. Colin, of the Alfort Veterinary School, has studied them in three hundred and fifty animals of various kinds, and he states that when an embryo-worm has penetrated the muscular tissue, it moves with considerable rapidity, insinuating itself into the interstices of the fasciculi, but not producing any appreciable dilatation or perceptible modification in the character of the tissue. As it grows it becomes more coiled-up upon itself in a spiral manner; and when it has assumed the dimensions it may acquire at this period, it forms around itself an elliptical space that results from the separation of the primary fasciculi, and not from their destruction or absorption by the worm, which can now easily be distinguished, as well as the space that exists between the kyst and the compact external tissue. Colin has never observed the kyst to be formed in the fashion described by Virchow,—at the expense of the muscular fibre and its envelope. It is exceptional that one capsule contains two worms; though as many as four have been noted. In this capsule the worm will live for years; for experiments have been made with flesh derived from an infected animal thirteen years previously, and in which the encrusted capsules were abundant. When animals received this flesh, the trichinæ became fully developed in them. The ingested flesh-worms do not appear to get beyond the duo-

dividuals in each species, and perhaps entire species, which offer a more or less powerful resistance to the migration of the worms to the muscles. In the pig they are frequently so slight as to be unperceived: though when quantities of the flesh-worm have been intentionally administered, the effects have in many instances been well marked, and more particularly in young creatures; herbivorous animals appear to suffer less than might be expected: though it is to be observed that young rabbits often succumb to the inflammation of the muscles which the parasites set up, as well as to the subsequent paralysis of the respiratory muscles. In the dog the muscular indications are very trifling, but the signs of intestinal irritation are sometimes intense. Leuckart has stated that in adult dogs, fed on infected flesh, it was ascertained that the trichinæ attained their sexual maturity in the intestine, and that the embryos did not usually traverse the intestinal wall, but were expelled alive with the fæces. Herbst, who was the first to demonstrate that the flesh-worms are transferable from one animal to another, has observed an innumerable quantity of these parasites in the muscles of young dogs which he had fed on the flesh of an infected badger. Leuckart (as just stated) and Probstmayer have also been successful in achieving this transmission; though they found only a very

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denum; there they are soon developed into the complete parasite, which no longer undergoes change, and the evolution of the creature into this state is very interesting. When an animal receives trichinosed flesh, it is found that the calcareous kysts are dissolved in the stomach, and the trichinæ, then set free, uncoil themselves in the small intestine, and assume their new development. In a few hours the generative organs appear towards the caudal extremity, and become visible for nearly their whole length; on the third day the ova have filled part of the oviduct; on the fourth the embryos are at the extremity of the canal, and the greater part of the body is distended by the reproductive apparatus. On the fifth day, the embryos are in motion, and they begin to escape on the sixth.

The number of embryos enkysted in the muscles may be so great, that about two pounds of pig's flesh will contain as many as five millions of trichinæ. At Plauen, where an epidemy of Trichinosis prevailed, in thirty grammes of pork there were 250,000 flesh-worms; and Probstmayer has counted 468 in four-and-a-half milligrammes of muscle. Five thousand females are sometimes found in a mouthful of flesh.

small number in the muscles of the dog. The majority of the animals they experimented upon were attacked with severe Enteritis. It was the same with cats, which, when they did not succumb to the intestinal disorder, had also some trichinæ in their muscles.

Experiments have not proved successful in developing muscular trichinæ in birds, though the intestinal worm has been so produced. Palmipedes and carnivorous birds appear to escape contamination altogether, according to some authorities.

The morbid manifestations occurring in animals, intentionally infected, also vary according to the intensity of the infection; this marks a difference between the parasitical and many contagious diseases. If only a few trichinæ are introduced, then the symptoms are proportionately slight.

The human species appears to suffer more severely from Trichinosis than the domesticated animals; and high-bred, and the most artificially reared pigs, seem to be more susceptible to the invasions of the parasite than the commoner kinds.

Though we have stated that the pig sometimes does not appear to experience any great amount of discomfort from the flesh-worm, when it is infected naturally; yet it must be borne in mind that, perhaps long before the period when the animal whose flesh has infected mankind was killed, all indications of the disease had disappeared with the completion of the migration of the trichinæ.*

The symptoms have been produced experimentally, by intentionally feeding pigs with infected flesh, in order to note the results, and to watch the course of the disease. These experiments have been conducted in Berlin, Dresden, Hanover, Hallé, Vienna, and elsewhere. Dr. Cobbold states that a pig experimented upon at the London Veterinary College, and in which it was calculated some sixteen millions of encysted

* It has been stated in this country, that, in the hog, trichinæ do not appear to be capable of occasioning inconvenience. This statement is not borne out by the experience of Continental veterinarians, who, as will be found in our description of the symptoms of Trichinosis, have sometimes observed most serious general disturbance, and even death, consequent upon pigs being fed with flesh infested by these entozoa.

muscle-trichinæ had been reared, exhibited no indication of suffering. The same has been observed with some of the pigs at the places just mentioned, and in others no characteristic symptoms were remarked; while others, again, showed much general and functional disturbance: evidently due to the irritation the trichinæ produced in the intestinal mucous membrane, when in great numbers there; or the irritation caused by their passage through the walls of the intestine, as well as the parenchymatous muscular inflammation brought about by the immigration of the embryos into the muscular fibrillæ, and the œdema of the connective tissue accompanying that inflammation.

The vague manifestations which marked these alterations, consisted in a diminution in the appetite and customary liveliness; the animals were frequently lying, and when standing they had the back arched and the tail drooping. In all the cases observed by Röll, there was present a violent pruritis, which forced the animals to rub and scratch themselves continually. This pruritis was probably due to the immigration of the trichinæ in the muscles of the skin, which caused irritation of the peripheral nerves. Most frequently old animals, or even those beyond six months, appeared to remain but little, if at all, affected by this immigration; young pigs were always more susceptible than aged ones.

In serious cases, the symptoms are due at first to the intestinal irritation, and at a later period to the muscular inflammation. The first is denoted by the diminution or suspension of the appetite (though this is rare), vomiting, distention of the abdomen, manifestations of Colic more or less severe, and Diarrhœa, which sometimes persists for weeks. There is also dulness: the pigs are inclined to lie a good deal, and to hide themselves beneath the litter, and if standing, as before noticed, the back is arched, and the tail pendent. Fever is present, the pulse is quickened, the body varies in temperature, and there is great debility.*

* Some interesting and important experiments were instituted at the Berlin Veterinary School, in 1864, by order of the Government, to ascertain several important points connected with this disease, and particu-

These symptoms ensue towards the end of the first, or commencement of the second week, after swallowing the

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larly the special symptoms, if any, which might distinguish Trichinosis in the pig from other affections. Four animals, as will be seen hereafter, were selected, viz.:—1. A sow eighteen months old; 2. A boar one year old; and 3, 4. Two hogs aged seven months. These were in perfect health, and before and during the experiment were fed on melted tallow and meal. They were separately lodged in a special stable. The experiment commenced on April 7, and trichiniferous flesh, weighing 250 grammes, was divided into four unequal portions, and mixed with the evening meal. No. 1, after some hesitation, consumed about 30 grammes; No. 2, about 135 grammes; No. 3, 30 grammes; and No. 4, 60 grammes.

During the three succeeding days nothing unusual was observed. On the evening of the 12th, the appetite of all had begun to diminish; though their liveliness was unimpaired. On the 14th, and for two or three days afterwards, the fæces of the boar were serous and transparent; this Diarrhœa being alternated with tolerably consistent, and sometimes normal, alvine dejections, which were covered by a thick coating of mucus.

The appetite gradually diminished, until at length scarcely one-fourth of the daily ration was consumed. After the 17th, the animals were constantly lying, groaning much, and burying themselves in the litter. The skin was covered by a viscid humidity; the conjunctival membrane was injected, dirty-looking, and tumefied; the snout was hot and dry; the heart's beats quickened; the skin was not very sensitive to the touch; and the limbs were cold; though the pigs still exhibited some liveliness. Roused by the voice or gesture, they got up quick enough, and did not manifest any stiffness in movement. Pressure on the muscles and the abdomen did not cause any pain.

From the 18th to the 22nd, the sow showed signs of Colic: lying down for a few moments, getting up again quickly, moving about the litter, and rolling and groaning heavily. Its respiration was quickened, and the skin covered with a gluey perspiration.

From the 14th to the 26th April, the fæces were carefully examined, microscopically, twice a-day, but no trichinæ were discovered. Though the quality of the food had been improved, visible emaciation had commenced. From April 23rd, the Diarrhœa disappeared, and Nos. 1, 3, and 4 offered nothing abnormal in the excretory or secretory functions; the nose had become moist, but the conjunctivæ were still of a dirty-red hue. The animals continued to remain lying, and exhibited great debility. Up to April 27th, the boar had not only become considerably emaciated, but it would not get up voluntarily; and when up it lay down again immediately,

trichinæ; and, with the exception of the Diarrhœa, they disappear after lasting from six to eight days, if death does not

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emitting an almost continuous dull hoarse groan. From the 24th, a certain rigidity had been observed in the posterior part of the body, which kept increasing; so that at last its movements became cramped and difficult. The skin and visible mucous membranes became more and more pale, though no œdema was noticed; the eye had a humid lustre, like that of a sheep affected with "rot;" pressure on the muscles did not occasion any pain. On April 28th, two small portions of muscle were removed from the common extensor of the left fore-foot and examined microscopically, and an abundance of trichinæ were observed; they were for the most part approaching the spiral form, and looked not unlike an elongated figure 6; some were merely bent at each end, and there were no capsules.

From April 27th to May 1st, the appetite improved every day with Nos. 1, 3, and 4, and the ration of food was almost entirely consumed. The boar, however, lay on its side groaning and moaning, and with great difficulty could be raised; when it attempted to walk, its hind quarters swayed from side to side; the appetite diminished every day.

On May 2nd, some muscular fibres were removed from the extensor of the left fore-arm and one of the flexors of the leg of No. 4; a great quantity of trichinæ were found in these, and capsulation had commenced. The trichinæ were of different sizes; and when isolated, their extremities moved freely, or they increased or diminished their spiral convolutions.

Cold water rendered these movements more striking, though they were also induced by heating the object-glass. In an hour or an hour and-a-half, the isolated trichinæ lost their spiral form, and assumed that of an elongated 6, with a double contour; an hour later their movements ceased, but on adding a drop of liquid ammonia they again commenced in the most lively manner, though they only lasted for an instant, and the worms once more assumed the simple elongated 6 shape.

From the 2nd to the 6th of May, the boar could no longer get up unaided; emaciation made rapid progress, and the conjunctivæ had become very pale. The other pigs, on the contrary, improved every day. On May 6th, some muscular fibres of No. 3 were examined microscopically, and were found to contain a prodigious quantity of trichinæ. Several subsequent examinations yielded similar results. From May 10th to the 18th, the condition of Nos. 1, 3, and 4, was so satisfactory, that no one could have asserted that they were not in excellent health. The boar, however, took no food; sometimes it had Constipation, at other times Diarrhœa: when the fæces were serous, greenish-yellow in colour, and had a very putrid odour. It died on the night of May 25. The morbid alterations,

occur within that time, as sometimes happens with very young pigs, or those which are older, and have received a very large

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will be described when treating of the pathological anatomy of the disease.

As feeding the pigs on trichinosed flesh had only produced a fatal result in the boar; and as it might have been supposed that the quantity consumed by that animal was not without influence with regard to the intensity and gravity of the disease; it was decided that the three pigs which had apparently recovered should be given as much of the flesh of the boar as they would eat.

On May 26, 27, and 28, No. 4 consumed nearly 500 grammes; No. 3, about 750 grammes; and No. 1, a kilogramme. So early as the 29th, the appetite had almost entirely disappeared, and the symptoms above-described again manifested themselves, but with greater intensity. Towards the end of June and commencement of July, Nos. 1 and 4 died from the disease, and an examination of their bodies discovered lesions similar in every respect to those observed in the boar. No. 3 survived, and soon appeared to be in perfect health; in fact, when the symptoms had disappeared, which of course happened when the trichinæ had completed their immigration, the animal grew in size and fattened as readily as if it had never been affected. At the usual periods of "rut," it gave indications of this condition, but it was not bred from. In the course of the year, portions of muscle were abstracted from different parts of its body, and they were found to be infested as has been described. Up to April 8, 1865, the capsules containing the trichinæ had not yet become calcareous. Twelve months after the commencement of the experiments, the animal was killed by effusion of blood. The condition of its flesh will be described when treating of the pathological anatomy of Trichinosis.

It is worthy of note that No. 1 was with young when it died, and near the completion of pregnancy, but the fœtuses did not contain any trichinæ. A cat also, which frequented the dissecting-room, and had no doubt eaten some of the pigs' flesh, towards the end of April showed all the symptoms of Trichinosis. The flesh of its kittens, however, when carefully examined with the microscope, did not offer any worms.

From his experiments and observations, Müller came to the conclusion that

1. The multiplication of trichinæ in the intestines of the pig, and their migration into the peripheral parts of the body, produce a sickly condition in that animal, but the apparent symptoms are neither sufficiently constant nor characteristic to enable Trichinosis to be diagnosed in the pig while alive; all the animals submitted to experiment became unwell a few days after eating trichinosed flesh, but the train of symptoms marking the disease belong equally to the intestinal Catarrh and gastric affections of pigs. In this species, the symptoms are the result of intestinal irrita-

quantity of the worms. Leuckart has seen several experimental animals perish from Peritonitis, consequent on perforation of the intestine by a great multitude of the worms simultaneously; and, in others, he has witnessed a peculiar form of Enteritis, with the ejection of false membranes *per anum*.

The muscular symptoms appear towards the termination of the second, or during the third week, after the ingestion of the trichinosed flesh; when the intestinal phenomena usually

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tion; the alterations found after death, in the first period of the disease, are a proof of this. As the migration of the trichinæ is accomplished, the symptoms disappear; this occurs in about four weeks. The symptoms are all the more intense if the animal has ingested a large quantity of trichinæ; but otherwise they vary little in their character. In the severe cases, a fever of a typhoid type is observed, and this proves fatal. Trichinæ have not been found in the fæces; these parasites appear to remain in the mucus covering the interior of the intestine, and it would require a drastic purgative at least to remove them. The only characteristic and analogous symptom of Trichinosis in man that was observed in the pig, consisted in the peculiar infiltration of the conjunctivæ, which gave the eye a well-marked and brilliant, but glassy appearance.

2. The first symptoms of the disease are usually observed from the third to the fifth day after the ingestion of the trichinosed flesh; those due to intestinal derangement continue about four weeks, and may, as has been said, cause death, either after assuming a typhoid character, or after paralysis and marasmus have set in.

3. The passage of the trichinæ into the muscles of the fœtus has not been observed in the pregnant sow. Similar remarks have been made with regard to women who have died during advanced pregnancy.

4. The reproductive faculty of the trichinæ in the intestinal canal is very precocious. Already towards the seventh day embryos are observed in the females, which are much more numerous than the males.

Enkystment has not been observed before the twenty-first to the thirty-third day.

In an additional note, Müller states that the calcareous transformation of the trichinous capsules noted in some subjects, does not commence in the year succeeding the migration of the trichinæ; and that this transformation ought, therefore, to be very rarely observed in the pig, as this animal is nearly always slaughtered for food before it is two years old. Likewise, that the presence of trichinæ in the muscles of the pig, when once the animal has recovered from the intestinal Catarrh, has no influence on its growth, fattening, &c.

become less marked, and the fever increases in intensity. At this stage the patient is often lying; in walking it carries its back raised and the limbs stiff, and manifests signs of pain; mastication, opening the mouth, and swallowing are difficult; the voice is harsh, husky, and weak; the respiration laboured and loud; cutaneous œdema appears in different places, together with the intense pruritis already alluded to; the conjunctival membrane is most frequently injected, and emaciation rapidly sets in. If the number of migratory trichinæ is very great, death may be the result, though this is somewhat rare in the pig. Usually the different symptoms disappear gradually, and it is only in very debilitated animals that convalescence is slow. The presence of trichinæ in the muscles does not appear to exert any subsequent influence on the development or fattening of the animals which harbour these strange creatures; on the contrary, it has been stated that they fatten more readily than before they were infested.

There is, then, nothing very characteristic in the symptoms above enumerated, though they may chance to be most severe. The signs of intestinal irritation may pass unperceived, or be ascribed to another cause; and those of the muscular disturbance might be attributed to rheumatism. If we reflect that, in ordinary cases of natural or unintentional infection, a considerably less quantity of trichinosed flesh is swallowed than is given experimentally, and that consequently the morbid symptoms are not very noticeable; it is easy to explain why the symptoms of the disease are overlooked by the owners of the affected pigs, or are attributed to any but the real cause. And this obscurity is still further increased by the fact, that pigs are less under observation, and less cared for, than the majority of the domesticated animals; so that when the migration and subsequent transformation of the trichinæ in the muscular system is effected, the symptoms of *malaise* gradually and completely disappear, and the animal looks as well as any other that does not contain these dangerous denizens. This circumstance renders a careful and minute inspection of its flesh all the more necessary,

particularly in those countries where it does, or is likely to, prevail.*

PATHOLOGICAL ANATOMY.

The more noticeable alterations are certainly those due to the local disturbance, consequent on the presence of the trichinæ, and need not here be specified in detail, as they offer diversities which can easily be anticipated by those who have studied the symptoms. A typical case may, therefore, suffice to indicate the morbid appearances observed in an animal that has perished from Trichinosis.

With a view to ascertain whether, after the pig has consumed trichiniferous flesh, that animal offers symptoms which might characterize the presence of the disease, and so afford a solution to a sanitary question of the highest importance, the Prussian Minister of Public Instruction and Medical Affairs invited the professors of the Berlin Veterinary School to make a series of experiments. This request was complied with, and four pigs (a sow aged eighteen months, a boar aged twelve months, and two hogs aged seven months) in perfect health were obtained. After presenting the symptoms already detailed in the note on page 491, one of the animals (the boar) died on the seventh week, and an examination of its body gave the following results:—Extreme emaciation, and traces of decubitus on the elbows, hocks, and haunches. Notwithstanding the marasmus, some layers of fat still remained between the abdominal muscles, around the diaphragm, and in the mesentery and omentum. The superficial veins were gorged with coagulated blood, but the flesh was of a good colour and appeared healthy. To the naked eye it offered nothing unusual, and a lense that magnified two or three diameters discovered no traces of the trichinæ. The abdominal and thoracic pleuræ were a little pale, but they contained no serum. The intestines were moderately distended with gas, and the small intestine contained a grayish-yellow fluid ; the mucous membrane, particularly that of the small intestine, was softened and

* The symptoms in mankind are not dissimilar to those observed in the pig.

little changed in colour, though covered with a layer of thick mucus rich in epithelial *débris*. The intestines contained no trichinæ. The lungs were velvety to the touch, and did not collapse completely when the thorax was opened. Their tissue showed here and there some hard calcareous nodosities, the size of a lentil; both lobes likewise exhibited patches of inflammation of a deep-red colour, and hard to the touch. There was a slight adhesion between the heart and pericardium. The left ventricle contained much coagulated blood, and some clots of fibrine extended for a considerable distance into the aorta. The muscles contained a great number of trichinæ; the muscular portion of the diaphragm especially was so crammed with them, that a small portion weighing scarcely the sixth of a grain contained more than fifty. The other muscles containing most trichinæ were those of the abdomen, the ilio-spinalis, those of the lumbar region, the thighs, shoulders, and arms. Those of the jaws, tongue, pharynx, and neck, were equally crowded. In the extensor and flexor muscles of the limbs, they were less numerous as these were examined near their attachment. In the muscles of the lips, snout, and the last coccygeal bones they were rare; but they were numerous in the small muscles of the ear and the abdominal panniculus. The structure of the œsophagus was full of them throughout nearly its entire length: their numbers diminishing towards the stomach, near which there were none. The heart did not contain any.

In another series of experiments on three pigs, two died; these offered the same pathological alterations as the one just alluded to; the other was killed a year after the commencement of feeding on the infested flesh, and its muscles were full of trichinæ. The capsules were yet quite transparent, and contained one, two, and even three, trichinæ. These, after being expelled, executed the liveliest movements when the glass slide on which they were placed was gently heated. Those remaining in their capsules scarcely moved.

In order to give an idea of the number contained in the flesh, Müller removed from twenty-four different muscles some fibres weighing about a grain. The worms contained in each

of these grains of fibre were counted, and after many proofs and counter-proofs, the following was the result :—Muscles of the tongue (per grain), 105 trichinæ ; those of the pharynx, 126 ; œsophagus, at three centimètres from the diaphragm, 31 ; the muscles on the outer side of the arm and shoulder, 18 ; those of the eyes, 64 ; the serratus magnus, 39 ; muscles of the fore-arm, 17 ; muscles of the abdomen, 54 ; diaphragm, 129 ; muscles of the loins, 161 ; of the thigh, 26 ; of the tail, at seven or eight centimètres from its root, 1. Thus the twenty-four grains of muscle from different parts of the body contained 970 trichinæ, or an average of 44 per grain.

Very numerous researches by other observers demonstrate that all the striped muscles are not equally liable to become infested by the trichinæ, if we exclude those cases in which the immigration has been enormous, and in which they are found in all these muscles except those of the heart. According to Röll, these are in general the parts nearest the trunk, then the anterior portion of the body and the diaphragm, which are most occupied by trichinæ. The muscles which are most infested are : the diaphragm, masseter, temporal, digastricus, muscles of the neck, loins, larynx, eyes, and abdominal parietes ; even in these muscles, the parts nearest the insertion of the tendons are most numerously occupied. The heart and other involuntary muscles are never involved, according to this authority.

The muscles for which the parasite has most predilection, according to French observers, are those classed as follows :— diaphragm, intercostal muscles, those of the abdomen, larynx, head, &c., and last of all, the muscles of the limbs and tail. These authorities are also unanimous in declaring that trichinæ are never found in the heart, fat, tendons, nor fibrous tissue, and that their agglomeration is always greater around the attachments of the tendons than elsewhere.

It would appear that all the voluntary muscles, and those of the œsophagus, are the special haunts of the flesh-worm.

DIAGNOSIS.

As has been mentioned, there are no special pathognomonic indications sufficiently marked to allow a reliable diagnosis to be formed of this disease. Nevertheless, though certain symptoms are common to it, to intestinal irritation or catarrh, and to gastric disturbance, their presence should lead to a suspicion of Trichinosis: particularly if trichinæ have been already discovered in the flesh of other creatures in the locality. When such a suspicion exists, or if there is any reason to suppose that living pigs in apparent good health are the bearers of the worms, a positive diagnosis may be arrived at by excising small morsels of flesh, and submitting them to microscopical examination. These should be taken from different parts of the body, and especially from those muscles which observation has proved to be most infested: such as the muscles of the neck, lumbar, sacral, antibracial, scapular, crural, and tibial regions. As this operation, however, is sometimes very difficult, recourse may be had to the harpoon used in several of the German markets for extracting a few muscular fibres. The harpoon modified by Kuhn is the most convenient; though even with this the operation is often troublesome in some parts of the body, in consequence of the more or less thick layer of fat beneath the skin. And when no trichinæ are found in some fibres, their absence cannot safely be relied upon as a proof that the animal is not infected: though such a circumstance must be rare. As in all the pigs experimented upon by Müller, the muscles of the tail were found to harbour the parasites, that veterinarian proposes ablation of a portion of the organ, in order that it might be carefully examined.

The mode of examining flesh to ascertain whether trichinæ are present, will be referred to when speaking of the sanitary measures applicable to this disease.

VITALITY OF THE TRICHINÆ.

The vital tenacity of the flesh-worms is an important inquiry, in a sanitary point of view. It would appear to be somewhat considerable, as they readily withstand a temperature ranging from 98° to 122° (Fahr.); they do not immediately perish when exposed to 143° to 149°; though a temperature of 158° to 177° is certainly fatal to them. Müller made some experiments to test the vitality of the trichinæ. He fed rabbits with salted trichinous flesh which had been kept in brine for eight to ten days. It had a good appearance, and the unaided eye could not distinguish it from ordinary flesh; under the microscope, the worm capsules were darker-coloured than in fresh muscle, being of a yellowish-brown hue, and less transparent. Their tenacity and resistance were so great that it was difficult to crush them, in order to expel the trichinæ, which did not exhibit anything noteworthy, and remained motionless. On April 19, 20, and 21, 1865, he gave twenty-four grammes of this flesh to two rabbits—twelve grammes to each. These creatures did not afterwards evince any signs of disease, and on May 12 one was killed and examined. Nothing abnormal was found in the abdominal and thoracic cavities, but the muscles were occupied by fully-developed and enkysted trichinæ; some were also found in the mucus of the small intestine. On May 20, the other rabbit was killed, and its muscles were likewise discovered to be occupied by worms; though they were not so numerous as in the other.

In order to ascertain how long the trichinæ would live in decomposing flesh, Müller exposed some pieces to the open air, and others he macerated in water. At the end of four weeks he found that the trichinæ, when isolated and slightly warmed on the object-glass, moved about in every direction. In five weeks, when the flesh was reduced to a soft pulp, the trichinæ and their capsules could still be recognized; but no movement was observable, notwithstanding the high temperature resorted to. He came to the conclusion that salting pork without the

addition of water will not kill trichinæ, unless it is cut into very thin pieces; and that the parasites will maintain their vitality for thirty-two days in flesh in a state of decomposition.

Fuchs, in endeavouring to ascertain how long the muscle-worms could maintain their existence under certain conditions, found that maceration in water beyond eleven days appeared to kill them; though they resisted putrefaction for a longer period. Placed in the soil of a flower-pot, they lived for many days, and did not become decomposed until some time after the flesh in which they were located. It was inferred that the degree of resistance depended upon the size of the piece of flesh; it varied from nine to twelve days.

From all the experiments which have been undertaken to test the limits of vitality in the trichinæ, it appears that they will withstand drying in the air or the sun, steeping in water, and putrefaction in flesh, and sustain a temperature approaching freezing and boiling, without losing the powers of evolution when circumstances permit. Prolonged boiling, or slow and thorough roasting of trichinosed flesh, is fatal to the parasites. Colin states that, in his experiments, he found trichinæ which had been enkysted in the muscles of an animal for four years, as lively as if they were only a few weeks old.

INFECTION.

The disease is transmissible to a large number of species, including man; he appears to possess an almost special aptitude to receive it.*

MODE OF INFECTION.

In speaking of the causes of Trichinosis, we have suffi-

* Badoky, of Pesth, has discovered enkysted trichinæ in poultry. They were observed more especially in the walls of the succenteric ventricle and the intestines, though not in the voluntary muscles. On the surface of the intestine they formed little transparent bladders, appearing to the naked eye as small white points.

ciently indicated the mode in which infection takes place, viz.: by eating flesh, or other matters containing the flesh-worms.

MODE OF ACCESS.

The only way yet known in which the trichinæ obtain access to the body, is by the digestive organs.

EXTENSION.

The disease is extended by people or animals consuming the flesh of creatures infested with the parasites.

MORTALITY AND LOSS.

From the obscure nature of the malady, and the fact that it may be readily mistaken for other diseases of a fatal kind, we know not how many animals perish from it; but the results of the Continental experiments would seem to prove that it causes a pretty high per-centage of deaths, when it prevails in a locality—probably as many as twenty per cent.

In the human species, the mortality in some outbreaks has been severe. At Hettstadt, for instance, one hundred and fifty-nine persons were affected from eating the raw or improperly-cooked flesh of trichinous pigs, and of this number twenty-eight perished; and at Hedersleben, where the disease prevailed from the same cause, more than three hundred persons were affected, and more than a hundred fell victims to it. It has been the same elsewhere.

In Germany, two pigs, supposed to be quite healthy, infected more than forty persons.*

* Several serious outbreaks in the human species have occurred recently. In 1873, for instance, more than two hundred and fifty persons were affected at Madgeburg, Germany. Of these a number died, and more than fifty were in a serious condition. Morsels of flesh, weighing about a gramme, removed from them by a trocar, contained as many as eight hundred trichinæ; and they might have been reckoned by millions in the body of a soldier, who perished after thirty-two days' suffering.

IMMUNITY.

Few animals, it would appear, experience immunity from this entozoön; but some species, and individuals of species, suffer less from its effects than others. Dogs and cats, and rats and rabbits, withstand its migrations, and subsequent encapsulement, better than some other species. Age has also a marked influence, young animals suffering more than adult or aged ones. Cobbold reared, it was estimated, fifteen or sixteen millions of trichinæ in an adult cow, which never betrayed any symptoms of pain, nor lost its appetite for a single day. Thudichum experimented with three pigs, each less that three months old, and two became ill, while the third died. The degree of infection has, of course, to be taken into consideration.

SANITARY MEASURES.

In consequence of the great danger to health and life to which mankind is exposed, even from the existence of one trichinosed pig, the chief aim of sanitary science should be to prevent in every possible way the infection of pigs by trichinæ, and to hinder these parasites from passing to the human species —the principal object being, of course, the preservation of the latter from Trichinosis.

As pigs may in some instances receive trichinæ from other pigs, and from the remains of these given to them as food, it is necessary to pay particular attention to their feeding, and the cleanliness and suitability of their dwellings; to prevent rats and mice entering these; to keep the pigs confined to their sties, and not to allow them to eat the *débris* of dead animals unless thoroughly cooked, or to go about latrines, dung-pits, &c. These precautionary measures should, of course, be more rigidly observed in districts where Trichinosis is known to exist; and it would be well, while attending to the housing of the pigs, to feed them exclusively on a vegetable diet; or if animal food must be given, to be particularly careful that it has been submitted to a slow and thorough boiling previously.

By every means rats and mice should be destroyed, as they

are frequently the cause of Trichinosis in the pig; those killed or found dead should be buried deeply in a place where they cannot be reached by the pigs, or, better still, they may be burned.

Knackers should not be allowed to keep pigs; as it has frequently been observed that it is in their premises that all the conditions favourable for the infection of these animals are found, because of the great quantity of flesh and offal generally lying about, and the numbers of rats which swarm in such places.

In Austria, where Trichinosis in mankind has hitherto been a rare disease, it has always been the case that rats from knackers' yards are infested with fleshworms to the highest degree. This is the reason that, in the Austrian empire, pigs are not allowed to be kept in knackers' establishments. This law might advantageously be extended to private slaughter-houses, where pigs are frequently kept to eat up the *débris* and filth lying about the floors; pigs are also often slaughtered there, and it is known that herbivorous animals *may* harbour trichinæ.

It would also be well to examine, on an extensive scale, the rats captured in a locality or country; as experience has shown that in this way foci of the parasites may be discovered in regions until then supposed to be exempted from their presence. We must remember that the *Trichina spiralis* was first accidentally discovered in England by Professor Owen in the muscles of a man who was being dissected; and that Trichinosis may be a far more frequent disease among men and animals than is usually supposed.

The carcasses of animals which contain trichinæ, no matter how few these may be, should be burned or deeply buried; with perhaps the exception of the tallow, which should be melted at a high temperature. The animals which have cohabited with these ought to be watched, and their bodies submitted to a microscopical examination after death.

Those creatures which have cohabited with the infested, or any animal that presents symptoms that resemble those of Trichinosis, may have portions of their flesh examined while

they are alive, by means of the harpoon, or in the manner recommended by Müller. This can be readily carried out in pigs that have lived with infested ones, or in those of a locality or country where the disease is known to exist.

When Trichinosis appears in one or more persons, every effort should be made to ascertain the source of infection, so as to destroy it and adopt precautionary measures.

The localities in which Trichinosis has been discovered should be advertised by the authorities, in order that the public may be on their guard against accidents from the use of the pork sold therein; it may be necessary to interdict the sale of pork in these places, and the slaughter of pigs should, in any case, be carefully watched.

The total abstention from pork in such localities, if many pigs are reared in them, and this commodity forms a considerable proportion of the public food, could not well be recommended, as it would prove a great and unnecessary hardship. If, under such circumstances, the precaution is adopted of not eating pork unless it has been found free from trichinæ, or prepared in such a manner that these parasites are certainly killed, there need be little cause for alarm.

INSPECTION OF FLESH.

For this reason it is that the inspection of the carcasses of pigs is a most essential measure in such cases, and too much

Muscle with *Trichinæ Kysts:* natural size. (Harley and Brown.)

care cannot be exercised in selecting competent persons to undertake this duty. For this inspection the microscope is necessary; as although the capsules in the flesh, and the trichinæ in the intestine, may be distinguished by the unaided, though practised eye, yet the presence of the parasites cannot be satisfactorily determined without this optical instrument.

If the examination is made by an incompetent person, it is rather dangerous than otherwise; as his inability to discover the parasites, when they are really present, may induce a false security, and thus cause the neglect of other precautionary measures.

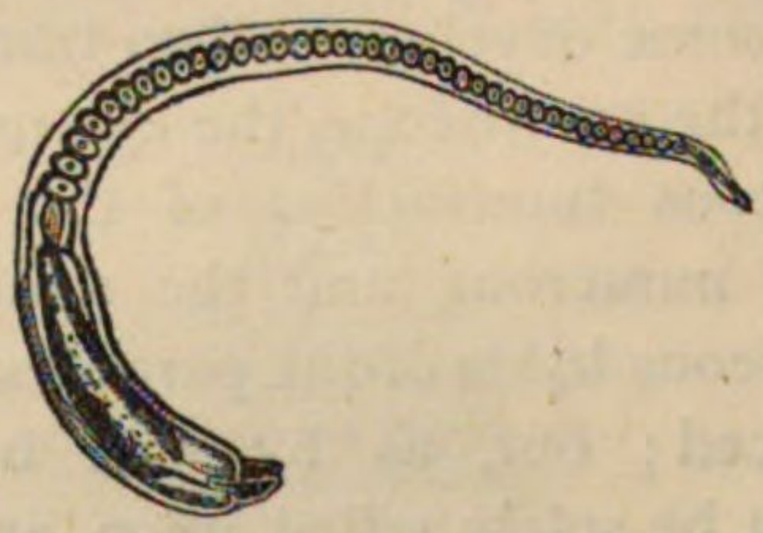
The inspector should, of course, be well acquainted with the character of the fleshworm, as well as the manner of searching for it in the tissues of the animal; and as it is too small to be easily distinguished by the naked eye, a magnifying power of twenty or thirty to fifty diameters is necessary; though if it be desirable to discover the wandering embryos—a more difficult task—a much higher power is requisite. We have already mentioned, however, that flesh containing these worms in transit is not injurious, as they cannot be transformed in the intestine unless they have attained their complete development in the muscles.

There is no difficulty attending the microscopical search for the parasites when they are enkysted—from the third to the fifth week after their immigration; and this is the stage at which they can become developed when transferred to the intestines. Without the microscope, the eye may discern a paleness and œdematous tumefaction of the tissues when the trichinæ are very numerous, and the minute round specks marking the calcareous kysts of the parasites when encapsuled may also be noticed; but, as has just been stated, these appearances cannot be solely relied upon, and the microscope must be employed. There are then seen in the primary fasciculi of the muscles, at each point corresponding to a kyst, a pale, spherical, or oval dilatation in which the trichinæ is rolled up. This space is prolonged at each end, and terminates usually in a round or truncated *cul-de-sac*.

The portions of muscular fibrillæ beyond these points are atrophied, and the connective tissue in the neighbourhood is inflamed.

Isolated Kyst of the Trichina: magnified 200 diameters.

As the capsule becomes thickened it also changes its shape, assuming something the form of a citron, or it may become spherical; towards its poles adipose matter is deposited, and, finally, calcification begins at these points and involves the whole kyst. The latter transformation, however, is rarely observed in pigs, as they are usually killed for food before this process commences. But if at this stage sections of the muscles are treated with acetic acid or caustic potass, small white points corresponding to the capsules are remarked. If hydrochloric acid be added to the cretified capsule, effervescence will take place, and the opaque spot will disappear.



Fully-developed Trichina, filled with ova: slightly magnified.

The fully developed trichinæ must be sought for in the small intestine (the duodenum especially) of the suspected animal. It is found in the layer of mucus covering the lining membrane.

In the search after the muscle-trichinæ, thin sections of the flesh, in the direction of the fibrillæ, are made by means of fine scissors. This thin portion of flesh from one of the suspected muscles is put into a solution of liquor potassæ (one to eight or ten of water) for only a few minutes, till the piece becomes clear; for if kept in too long, the parasites will be destroyed. This steeping brings the trichinæ distinctly into view; but if the parasites cannot be discerned, owing to the thickness of the capsule, a drop of a weak solution of hydrochloric acid will remedy this. If fat obstructs the view, ether or benzine will remove it.

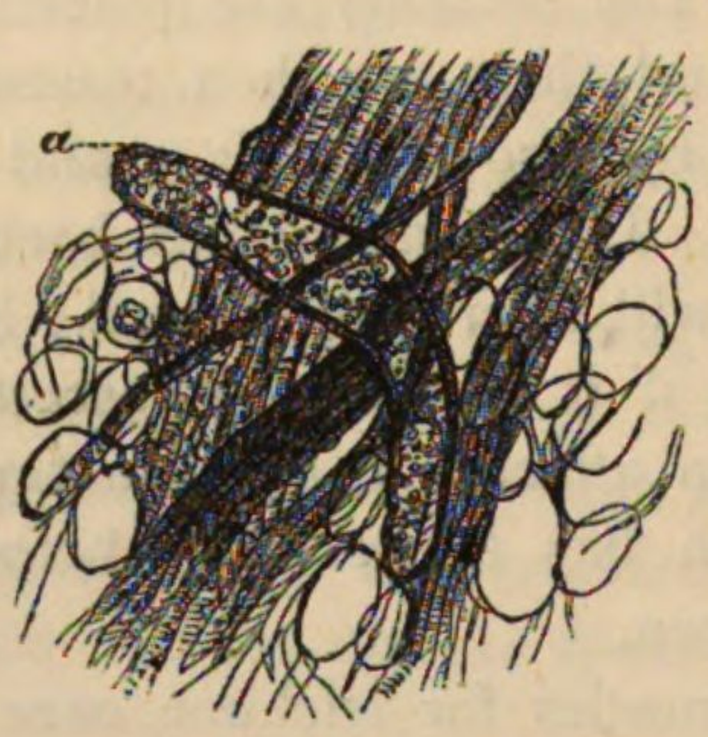
The muscles selected are, of course, those which are most liable to be infested, even in the mildest cases: such as the diaphragm, masticatory muscles near their insertion, laryngeal muscles, the intercostal muscles, and those of the fore-arm, thigh, and leg. The sections are placed on a glass slide, water is added, and they are then teased out by means of needles, protected by a covering-glass, and placed in the field of the microscope. If the animal has been seriously infested by trichinæ, they will soon be perceived; but if the infection has been slight, or if it is desired to ascertain whether or not an animal has been affected at all, sometimes long-continued and careful search has to be made before a conscientious opinion can be given.

In examining muscles for trichinæ, care must be taken not to mistake certain other minute bodies for them, as these, so far as we know at present, appear to be almost harmless. One of these is known as a "Psorosperm," "Utricle of Miescher," or "Rainey's capsule," and the other is designated a "Concretion."

The *Psorospermia* are almost transparent utricular bodies, with round or pointed ends, and are invested in a finely-marked membrane; they are met with in the primary fasciculi of the muscles of cattle, sheep, and pigs. They contain in their areolar vacuoles, spherical, elongated, or reniform corpuscles, provided with one or more nuclei; in rupturing the utricle, the character of the corpuscles can be readily made

out. These Rainey's capsules, though narrow, cause a dilatation of the primary fasciculi at the points where they are situated; but they never produce any alteration in the texture of the muscles like the trichinæ, and do not appear to exert any influence at all on the muscular substance, the transverse striæ even being preserved. They lie within the sarcolemma, and if they are very numerous, they may be seen with the unaided eye: appearing as fine white streaks, analogous to the thin layers of fat that become defined when flesh is treated with acetic acid.

These psorospermia do not appear to exercise any serious influence on the health of the domesticated animals, with the exception of the pig; though they have been found in enormous quantity in their muscles. They have not been found in the human species.



a Psorosperm imbedded in a portion of muscle. (After Brown.)

Röll only knew of one case in the pig, in which, by their enormous quantity, they obstructed the movements of the voluntary muscles. It has also been reported that they have produced marked symptoms of disease in pigs: two of the characteristic symptoms being paralysis of the posterior limbs, and an eruption of nodules or spots. Leisering states that they sometimes accumulate enormously in the muscles of the œsophagus, giving rise to pseudo-abscesses, some of which are the size of a nut, and containing a white pus-like fluid in which are innumerable psorospermia. The pigs often perish

suddenly. Siedamgrotzky had also found them in large numbers in the pharyngeal and œsophageal muscles of horses. In this situation they assume large dimensions—the size of a haricot-bean or small nut; while in the muscles of the back, diaphragm, and those of animal life in general, they are scarcely visible to the naked eye.

Neiderhausen, of the Berne Veterinary School, found them in the œsophagus of a goat which was in a state of emaciation, and which had been ailing for a long time. Anacker, of the same school, has found, in the utricles, bodies like the bacteria of Anthrax, with filaments of some parasitic vegetable similar to the *Achorion*. They are not rare in pigs affected with Anthrax or epizoötic Erysipelas. They are also nearly constantly found in rabbits, which burrow in damp ground, or whose dwelling is damp; but rarely, if ever, in dry burrows or hutches. Quite recently, Rivolta and Silvestrim have witnessed an epizoöty among fowls, in whose bodies they found numerous utricles; these were lodged in the pharynx, larynx, œsophagus, and sometimes in the pituitary and conjunctival membranes. These birds had been ingesting micrococci in their food; and cleansing the place in which they were kept, resorting to disinfection, removing all manure, &c., caused the disease to disappear. Gurlt, Winckler, Daman, Mauz, Zundel, and other veterinarians, have noticed the extraordinary frequency of these bodies in the œsophagus and pharynx.

The flesh in which the psorospermia are fixed is not injurious as food, though to the eye it may be unpleasant. It has been given experimentally to many animals of different species without any result.*

The "concretions" are grayish-white corpuscles, variable in

* The nature of these psorospermia is not yet ascertained, and it is undecided whether to include them in the animal or vegetable kingdoms. Kuhn, Robins, and others rank them in the former, and name them *Synchitrium mischerianum;* while Gerlach and other authorities consider them as belonging to the animal kingdom, because of their innocuousness in the primary fasciculi of the muscles. Anacker is disposed to coincide with Kuhn, and to consider them as belonging to the vegetable kingdom;

shape, and about the size of a grain of millet; they are, consequently, visible to the naked eye. Sometimes they are very numerous in flesh, and in other specimens are but few in number; their dimensions alone would distinguish them from the trichinæ kysts. Their physical character is not always the same, there being some which consist of a dense capsule of connective tissue containing calcareous matter.* Other concretions are less defined, appearing in lumps or leafy masses that are dissolved by acids, when the muscular tissue is found intact.†

The inspection of the flesh of suspected animals (all pigs should be considered suspected during an outbreak of Trichiniasis) may be optional or obligatory. The first is certainly to be preferred, if it ensures safety.‡ An obligatory inspection could only be conducted in the public abbatoirs of large towns and cities in which pigs are killed. In village and private slaughter-houses (in which so many abuses exist), it could scarcely be carried out. Nevertheless, if the disease is known to be present in a locality or district, an obligatory inspection should be strictly enforced.

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he thinks they are derived from mould on the food, and are merely the germs of these fungi in a state of immigration; in the tissues they set up a local inflammation, which gives rise to the white globules in the interior of the utricle, and in the utricle itself: the psorospermia and vegetable filaments being the products of the fungus.

* It is not yet established whether these concretions are the remains of prematurely deceased and cretified trichinæ, neoplastic formations, or calcified cysticerci; but it is probable that they are the second, from their size, which militates against the opinion that they belong to the trichinæ; while the absence of hooklets would tend to prove that they are not derived from cysticerci.

† Leuckart considers the concretions found in smoked hams to be probably formed during the smoking process, and composed of crystals of stearine or margarine. Virchow describes concretions he has met with in flesh, and which appear to be composed of guanine.

‡ This inspection is carried on to a great extent in some parts of Germany. At Nordhausen, the butchers have formed themselves into an association of inspection, and offer a sum of fifty thalers to any one who discovers trichinæ in the flesh they sell.

At the same time, directions should be publicly given as to the different methods of cooking the flesh of pigs, so as to ensure the destruction of any trichinæ that might be present.

CURATIVE MEASURES.

The curative treatment of Trichiniasis in the lower animals, with a view to destroy the muscle-worms, has been hitherto unsuccessful: all the various methods prescribed having only yielded negative results. The intestinal trichinæ might be removed by drastic purgatives; and the migrating worms might be reached by carbolic acid administered internally, and applied externally.

THE USE OF TRICHINOUS OR SUSPECTED FLESH AS FOOD.

The use of infested flesh is not to be recommended on any pretext; though there can be no doubt that, by proper management in the way of cooking, the danger of infection may be obviated. Suspected flesh, and, indeed, that of all the domesticated animals, should not be eaten raw, nor yet what is called "under-done;" and particular care should be observed that it has been exposed throughout to a temperature of at least 170° (212° is the boiling-point of water at the sea-level). With large pieces of meat, this temperature is rarely reached in the centre, and especially if the operation of roasting or boiling has been performed hurriedly. With suspected flesh, boiling is safer than roasting; and as an indication that a sufficient temperature has been reached, the reddish tint of the flesh, its softness, and all red-coloured juice, should have disappeared, and given place to a uniformly grayish-white hue and firm texture.

Long immersion in salt brine will destroy the trichinæ, as does also the salting and smoking to which pork is sometimes subjected, provided it reach the interior of the pieces; but in order to make assurance doubly sure, this preserved flesh should also be subjected to thorough cooking. Pork preserved by the external application of creosote, pyroligneous acid, or other substances of a similar kind, may be considered safe, so far as its surface is concerned; but if it contains any

trichinæ in its deeper layers, these will certainly not be destroyed. Therefore, exposure for a certain period to a temperature of 170° or 180° at least, should be ensured before such material is consumed as food.

From the observations which have been recorded from time to time, it would appear that the flesh of young or sucking pigs, or other animals, may be eaten with impunity.

MEASLES IN THE PIG.

SYNONYMS—Greek: *χαλάζαι.* Latin: *Porci leprosi.* Technical: *Cysticercus cellulosus* (from *κύστις*, a bladder, and *χέργος*, tail), *Scalesiasis, Cachexia hydatigena, Cestode tuberculosis.* English: *Measles, Leprosy.* French: *Ladrerie, Ladre, Noselerie, Pourriture de Saint Lazare.* German: *Finnen, Masern Hydatis finna.* Italian: *Rosolia.* Spanish: *Sarampion, Roña.*

GEOGRAPHICAL DISTRIBUTION.

This parasitical disease of the pig is probably widely extended, and prevails more or less in every part of the world where this animal is domesticated. Certain parts of France are notorious for rearing measly pigs; it is the same in other European countries, and particularly Germany and Hungary. In Ireland it has been considered enzoötic; but it is comparatively rare in England and Scotland. This difference depends upon the filthy habits of the people, and the absence of sanitary precautions with regard to pigs.*

* Wherever tape-worm (the *Tænia solium*) prevails, and pigs are improperly kept, the *Cysticercus cellulosus* will probably be found. In this way, we may fix upon the geographical range of the porcine disease. The solitary tapeworm is more or less prevalent in Europe, America, Australia, New Zealand, Asia, and Africa. It is not universally diffused in these countries, but may be perfectly unknown in some parts, and endemic in others: its limits being well defined sometimes. In Asia it is more particularly observed in Arabia, India, North China, and Syria (especially in Aleppo). It is frequent in Java among the negro soldiers, but rare with Europeans; it is not known among the Malays. It is far from uncommon in India, and measly pork is often found in the bazaars. With regard to Africa, it does not appear to be at all frequent in Egypt; but in Abyssinia, Senegal, and the island of Malta, as well as in Algeria, it is almost, if not quite, endemic. In Algeria it is, indeed, alarmingly common.

In Europe, though the *Tænia solium* is by far the most common, yet

It is very prevalent in Mexico, and it sometimes appears in a fatal and almost epizoötic form in Algeria.

It was known from the earliest times in the East; and it is not unlikely that it was this malady, together, perhaps, with the preceding, which caused the Israelites, in the time of Moses, to declare the pig unclean, and led them to prohibit, in the strongest terms, the use of its flesh, and even the mention of its name. It is not improbable that, for a similar reason, the Greeks and Mahommedans also disliked the pig. Aristophanes, Aristotle, Androsthenes, Aretæus, Ætius, Florentinus, Didymus, Pliny, Columella, Plutarch, and other ancient writers allude to it.

CHARACTER.

This disease is, like the preceding, due to a parasite or entozoön, in the form of a bladder-worm—the *Cysticercus cellulosus*—belonging to the *Cestoda*, or tape-worm class, the tape-worm being the *Tænia solium*. The larval cestode is, in reality, the sexually undeveloped progeny of the tape-worm, and infests other animals besides the pig; though in this creature it acquires most importance from the fact that its flesh is consumed as food by man and the carnivora, and the parasite is therefore transmissible to them. In this way it deserves men-

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another tape-worm, the *Tænia lata*, is frequently noted; but never, it would appear, in the same subject. The districts in which these two worms are prevalent are usually quite distinct, and on one side of a river the first may be common, on the other side the second. Thus, in the east of Europe, according to various authorities, the *Tænia lata* is found in Russia and Poland, but does not extend beyond the Vistula, as on this side of that river the *Tænia solium* prevails. This line of demarkation is so marked, that at Dantzic, situated on the Vistula, Siebold was frequently able to determine where people came from, according as they were affected with one or other of these parasites. At Geneva a fourth of the inhabitants are supposed to be infested by the *Tænia lata;* while at Zurich the *Tænia solium* only is known. As a rule, it may be said that the latter is most common in Italy, Greece, Portugal, Germany, Holland, France, and England; and the former most prevalent in Switzerland, Belgium, Russia, and Sweden (Boudin).

People who do not consume the flesh of the pig rarely suffer from tape-worm. Thus it is that among the Jews, Mahommedans, Brahmins, and other religious bodies, it is either very rare or altogether unknown.

tion in a work like the present. The disease is characterized, in the pig, by certain symptoms—external and internal—which are more or less marked, and which depend upon the stage of evolution of the parasite: it having a tendency to localize itself in particular regions. This parasite has been found in a number of animals, but more particularly in the different varieties of monkeys, the dog, and the bear; it has even been found in ruminants, according to some reports. These must, however, be looked upon as accidental cases of transmission.

NATURE.

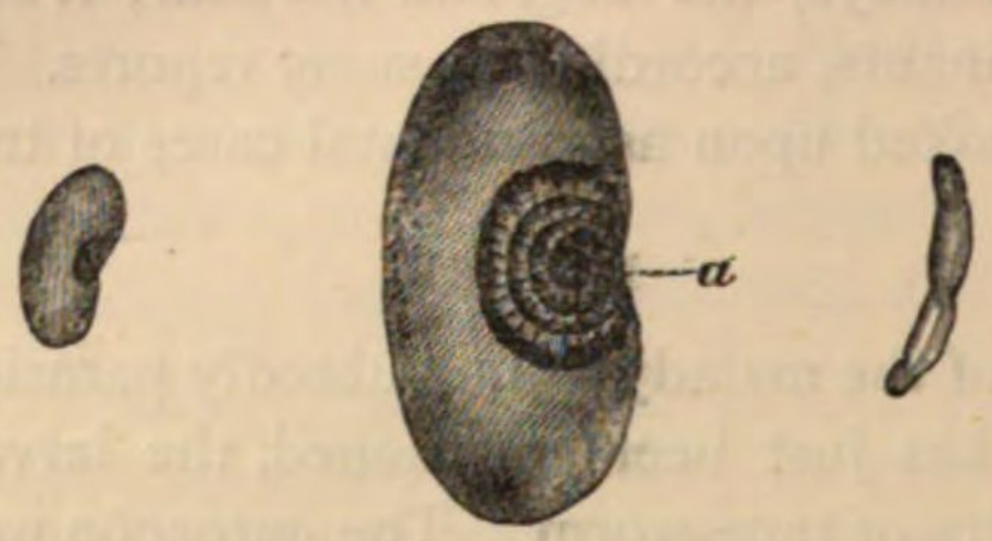
The nature of the malady is undoubtedly parasitic; the parasite being, as has just been mentioned, the larval or hydatid form of a variety of tape-worm. The entozoön was discovered by Redi, Malpighi, and Hartmann, the latter having found the cysticercus in a goat. To Rudophi it owes its name.

It is much larger than the *Trichinæ spiralis*, and is developed from the ova of the human tape-worm (*Tænia solium*), which, contained in the posterior segments of that creature's body, are generally expelled from the intestine along with the fæces. The ova in each segment (or *proglottis*) are swallowed; and in the pig the embryos (or *proscolex*) these ova contain, become developed into the hydatid or larval form (or *scolex*). The embryo is provided with six minute hooklets, and soon after being introduced into the interior of its host, it begins to penetrate the tissues in its immediate neighbourhood, until it has gained a favourable situation, where it assumes the hydatid or bladder form. This it maintains permanently, unless it is transferred to the intestinal canal of man, when it is advanced to the condition of the fully-matured solitary worm (or *strobila*). The completely developed hydatid is contained in a somewhat rugose envelope of thin, but firm texture, formed at the expense of the connective tissue of the part in which the parasite has located itself. When this is incised, the worm is discovered lying curled up in the cavity of the sac, surrounded by fluid; it is about one-third of an inch in its longest diameter, or from the size of a pea to that of a cherry; and when it is in the retracted state, it is somewhat oval or

elliptical in outline; but when the head and neck are extended, it is bottle or gourd-shaped, the wide portion being termed the *caudal vesicle*, or ventral portion. This vesicle is filled with an albuminous, milky-coloured fluid, and in the

MEASLE-WORM OF PIG.

Fig. 1. Fig. 2. Fig. 3.



Cysticercus of Pork.

Fig. 1. Natural size. Fig. 2. Magnified six diameters
a, *Albopunctatus* or *receptaculum capitis*.
Fig. 3. The same after steeping in salt : natural size.

Fig. 6.

Fig. 4. Head of Cysticercus,' or Tapeworm : full view.

Fig. 5. Ditto, profile: *a*, suckers ; *b*, rostellum; *c*, hooks.

Fig. 6. One of the hooks, highly magnified : *a*, stem fixed in the head ; *b*, barb ; *c*, point.

retracted state exhibits a dense white spot at one point of its surface (the *albopunctatus*, *a*, Fig. 2); this is the depression containing the head and neck of the cysticercus.

The walls of the vesicle, though generally transparent, or nearly so, are marked by very small calcareous points, which are chiefly concentrated about the head and neck: evidently to give it firmness and consistency. In order to examine the

head, which is very small, it is necessary to extract it from its cavity (or *receptaculum capitis*) with fine needles, or press or incise the vesicle; for though it appears to be lodged within the latter, yet it is external to it, and is withdrawn or invaginated in the depression like a finger inserted into a glove. This part of the parasite is square in shape when viewed from above, and conical when looked at in profile; it is furnished with four muscular suckers—one at each angle—and a small central depression, which some helminthologists have supposed to be a supplementary sucker, but which appears to be a rudimentary proboscis or *rostellum*. These suckers, the functions of which are obvious, are very conspicuous. The conical proboscis or rostellum is surrounded by a ring of hooks, sometimes alternately long and short, and from twenty-four to twenty-eight in number; these consist of a shaft, hooked extremity, and a barb in the middle. This part of the head is often dark-coloured. The neck or body is short, and consists of a series of ridges or folds, speckled with the minute lenticular calcareous particles already alluded to. The folds or ridges of the neck are really the miniature proglottides or segments, which become the reproductive organs, and furnish the ova when the hydatid has been transferred to the intestine of another creature.

The fully-developed worm which infests the human small intestine, may attain a length of from ten to ninety feet. Its head possesses the same characters as that of the hydatid; the neck is filiform; the first segments are short, but as they proceed towards the tail they become longer and are more square; the last, containing the mature ova, are longer than they are wide, and are obtuse at the angles. The genital orifices are irregularly alternate along the margin. The ordinary width is from three to four lines.

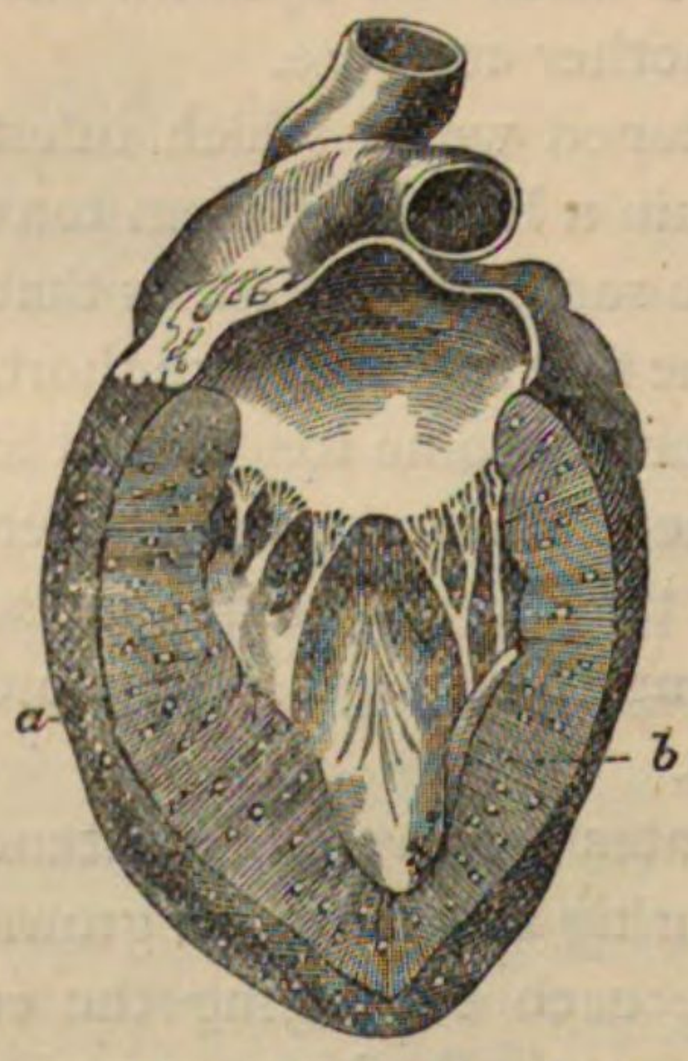
Leuckart estimates the average existence of each tapeworm at two years. During this period it grows at least 1600 proglottides or joints, each containing the enormous number of 53,000 eggs—being a total of 53,000,000. Were all these ova ingested by pigs, a very few people affected with tapeworm would infect the porcine population of a large region; but the

majority are destroyed; and it is not improbable that if pigs could be entirely prevented from swallowing them, tapeworm would altogether disappear, as well as the so-called "measles."

The ova, as they become mature, are nearly spherical in outline, and are about 1-2666th of an inch in length, and 1-8000th in breadth.

The hydatid in the pig lives alone in its kyst, and appears to have a special predilection for the muscles of the tongue, the neck, and the shoulders. Next in order, perhaps, are the intercostal muscles, those of the sublumbar region, loins, thighs, and croup; the heart, liver, lungs, and brain are not unfrequently infested, and in man they have been found in the brain, eye, and other parts, through the accidental swallowing of mature ova of the fully-developed worm. The serous membranes of the pig are sometimes invaded; it is rarely seen in the adipose tissue, but generally seeks the connective tissue in the interstices of the muscles, &c.

The heart is sometimes so much infiltrated with the cysticerci, that one wonders how its functions could be maintained. When located in muscular structures, the larger axis of the vesicle is always parallel with their fibres.



Heart of a Measly Pig infiltrated with Cysticerci. (After Mosler.)

Unless transferred to the intestines of another creature, the hydatid undergoes no further development.

CAUSES.

The only cause of Measles in the pig, is the ingestion by that animal of the ova, or proglottides containing these, of the tapeworm. These they find in human excrement; and it is notorious that the disease is common where pigs are kept in a dirty condition, badly fed, and allowed to frequent latrines and other filthy places. Delpech thought that the breed of the animal had much to do with the disease, and cites the Lorraine, Picardy, Mancelle, Norman, and Limousin breeds as particularly liable to it; but he overlooked the fact that in these regions the pigs are not attended to as they should be, and are only too frequently allowed to feed on every filth; and that tapeworm is more common among the people there than elsewhere in France. In the South-west of France, where the pigs are properly kept, Measles is very rare. No doubt can exist, however, as to insalubrious habitations, cold and wet, and scanty food, predisposing to the attacks of the parasite.

Some authorities have believed that Measles is hereditary, and sometimes congenital; and the same has been asserted of tapeworm in the human species. It may be taken for granted that a pregnant sow, ingesting the ova of the cysticercus, will, in all likelihood, contaminate its progeny; for when we know that the larvæ can find their way to the brain, liver, and heart, we cannot deny that they may also penetrate to the fœtus. In fact, the hydatids have been found in the bodies of newly-born pigs.

SYMPTOMS.

The disease more particularly affects young pigs, and those which are commencing adult life. As a rule, the symptoms are somewhat variable, and depend, not only upon the organs which the parasites have invaded, but also upon the number of these. When they are few, and are only located in the connective tissue or some unimportant organ, they cause so little disturbance that the pig appears in good health, and is killed without any suspicion being excited as to the presence of the parasites.

It is otherwise, however, when the textures are largely invaded, at one or more times, by the proscolex; and more especially when the hydatid stage has been reached.

The symptoms or pathological phenomena caused by the cysticercus are somewhat as follows: Externally, there may be no particular indication observable; the animal may be, to all appearance, perfectly healthy, and eat well, but perhaps it does not fatten satisfactorily. If this circumstance gives rise to suspicions as to the existence of Measles, the pig may be thrown down and secured; a round piece of hard wood is inserted between the jaws, across the mouth, like a gag, and being pressed obliquely against the tusks, the mouth is opened, and the tongue pulled out. This organ is then carefully examined at its lower part, particularly towards the frænum, and if one or more bladders are found, varying in size from that of a millet-seed to that of a pea, quite transparent or faintly opaque, and slightly projecting above the mucous membrane, then we may be positive as to the cause of the malady. The finger may be gently passed over these parts to be more certain, should no vesicles be visible; as sometimes they are absent from this region when they are in great numbers elsewhere. Though their presence here may therefore be regarded as a characteristic feature of the disease, yet their absence should not be accepted as a proof of its non-existence.*

* The sublingual vesicles are present so frequently in this disease, that from the very earliest times they have been looked for when pigs were suspected. Aristophanes, in the "Knights," alludes to the practice of examining the tongue of the pig, when, in the angry squabble between Agoracrites and Cleon, he makes the slave Demosthenes intervene with a speech, in which Cleon is compared to a measled pig: "By Jupiter," he exclaims, "do like the cooks; put a lever into his mouth, then pull out his tongue, examine it carefully and conscientiously, and searching from his open mouth to his interior, find out whether he has *hydatids!*" (χαλαζᾶ). The word χάλαζα properly signifies "hailstone," but it was employed at the same time by Greek writers to designate this disease, the verb χαλαζάω signifying the condition of the diseased pig. The term was no doubt adopted from the resemblance of the vesicles to hailstones. The antiquity of this method of examining a measled pig is, therefore, very great; and it is not improbable that the presence of the vesicles in this region was known to the sacrificial priests of the heroic ages, when large numbers of pigs

The visible signs of Measles are not always to be only looked for about the tongue; for though, in the great

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were offered as sacrifices to the gods, and a minute inspection was made of all the viscera. According to French historians, at an early period there were sworn inspectors of pigs in France, whose duty it was to examine the tongue of these animals, and who were therefore named "langueyeurs." In the reign of Louis XIV., these were Crown officials. At the present day there are such men, but they are no longer officials; they frequent the pig markets, and take their chance of being employed by any one who wishes to have his new purchases examined for Measles. According to Lafosse, these men show a good deal of expertness in performing this operation. They cleverly seize the pig by the left fore-leg, and giving it a push with the knee on the right flank, throw it on the ground on its side, where they hold it by kneeling on its shoulder; they then introduce their walking-stick between the jaws, which they open, and so maintain by holding the stick firmly beneath the arm and on the ground; the right hand being free, with it the tongue is drawn out of the mouth and examined, the fingers also being passed along its sides to feel for the vesicles. Demosthenes, the slave, undoubtedly alludes to this mode of inspection.

Aristotle describes the malady, and thought it was due to humidity of the flesh; he, nevertheless, mentions the existence of the χάλαζαι, and their presence in the muscles: those of the tongue, neck, and shoulders being, according to him, the most frequently and seriously attacked.

Rufus, the ancient Greek physician, says: "You may ascertain in the living animal if there are hydatids (*hailstones*, χάλαζαι), by examining the tongue and adjacent parts, for it is there that this symptomatic indication appears (διασημαίνει γαρ ἐνθαῦτα). He speaks of the flesh being unhealthy and unsavoury.

Androsthenes, in a passage of his voyage to India, quoted by Athenæus, compares the pearls formed in certain shells, to the vesicles of the pork Measle: "They grow in the substance of the mollusc, like the bladders in the flesh of the pig."

Aretæus compares the people affected with Elephantiasis to measly pigs, and speaks of the sublingual veins being very prominent, and the tongue studded with pustules like hailstones.

Pliny, who evidently transcribes from Aristotle, alludes to this malady; and Plutarch likewise mentions it, and says that the repugnance of the Egyptians to the flesh of the pig was the fear of contracting leprosy. It may be observed that the Romans gave the vesicles the same name as the Greeks—*grandines* or *grandini* (from *grando*, hail).

Columella, the careful and accomplished Roman veterinary author, notices the disease, and recommends, in the way of treatment, that the sublingual region be scarified, and when sufficient blood has flowed, this

majority of cases, this is the favourite *habitat* of the parasite, yet the same kind of bladders may manifest themselves about the ears, on the conjunctival membrane of the eye, and around the anus, when the disease is in an advanced stage.

When the malady has made much progress, the snout appears to become so unusually sensitive that the pig no longer attempts to use it in turning up the ground, and if struck gently on this part, it screams from the pain. At the same time, the voice is rougher than usual, and there may be a slight cough; the animal shows signs of weakness and languor, and it is indifferent to what is passing around it—not even responding to the voice nor caring for blows, and offering but little resistance to manipulation.

The appetite is also impaired, and the visible mucous membranes may be of a pale-bluish or red colour. The vesicles, if visible, increase in size, or others appear; and the dealers in pigs, and the butchers in those countries in which the malady is well known, recognize it by swellings about the shoulders (*les épaules remontées*, as the French designate this sign); these swellings are more particularly noticed about the withers, and give the animal an awkward, stiff appearance in its movements. This is a very characteristic symptom.

The disease is now reaching its most advanced stage, corresponding with the enkystment of the larvæ; and the symptoms rapidly assume their most serious aspect. The pig seems to be insensible to all external influences; it is nearly always lying, and if it tries to walk, it moves slowly, as if each step caused it the greatest agony. Infiltrations appear at the root of the

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part is to be rubbed with a mixture of salt and barley-flour (*sale trito cum farina triticea*).

We can trace the disease from the Roman writers, through the Middle Ages, up to the present day; but it is only when we come to modern times that the hydatid itself is discovered and its origin ascertained. Indeed, it was not until 1845 that the investigations of Steenstrup, Siebold, and Dujardin established the doctrine of alternate generation; and 1850 witnessed the discovery, through the wonderful experiments of Van Beneden, Küchenmeister, Lewald, Haubner, Leuckart, and Humbert, of the phenomena of transmigration and the metamorphoses of this and other cestode worms.

ears and the lower jaw, and the limbs become œdematous; the appetite is in abeyance, and Diarrhœa may be present; the eyes are lustreless, and perhaps concealed by the infiltrated conjunctivæ; the mucous membrane of the mouth is pale and sodden-looking, and marbled with bluish patches; the tongue is swollen and blanched, and the gums are spongy, and bleed at the slightest touch; the subcutaneous lymphatic glands are enlarged; the pulse is small, quick, and irregular; emaciation rapidly takes place; the breath has a most repulsive and characteristic odour; the voice is husky and jerking; the bristles are removed from the skin by the slightest traction, and a drop of blood appears in the place of each; the strength disappears, and the pig can no longer rise; vertiginous symptoms occur, especially if the hydatids have located themselves in the brain or spinal canal, when we may also have tonic and clonic spasms and paralysis, particularly of the posterior extremities; the limbs and abdomen become greatly swollen; the skin is thickened, and the connective tissue beneath distended with gas in various places; the body exhales a fœtid odour, and the creature perishes.*

* As has been mentioned, the *Cysticercus cellulosus* has been observed in the dog. The veterinary professor, Dupuy, according to Davaine, found a large number on the surface of a dog's brain. Gurlt has also discovered a great many in the muscles of a dog. The preparations containing these are shown at the Berlin Veterinary School. (See *Magazin f. d. Gesammte Thierheilkunde.* 28 Jahr. 34 Jahr.)

Roloff, veterinary professor in the University of Halle, in 1869 found the cysticerci in the lungs and liver (greatly enlarged) of a dog, where they formed numerous vesicles the size of a pea, and around them were tubercles varying in size from a grain of millet to that of a hazel-nut.

Leblanc, a Parisian veterinary surgeon, has described the symptoms produced by the parasite in the dog. In October, 1872, a medium-sized "griffon," aged fifteen months, was brought to him in consequence of its suffering from attacks of epilepsy. Most frequently very quiet, and even dull, it was seized, whenever it went out of doors, with convulsive movements, and lay for some minutes before it got up again. It was treated for cerebral congestion, with commencing ventricular effusion, which is not uncommon in young dogs affected with convulsions. Notwithstanding the treatment, the symptoms became aggravated, and were as follows: Convulsions without any assignable cause, grinding of the teeth and champing of

It is usual, however, to sacrifice the animal before the disease has made considerable progress, and to dispose of its flesh as food.

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the jaws, foaming at the mouth, and struggling when lying on the ground. There was a marked and increasing tendency to turn to the left ; the coma became more urgent, and the animal appeared quite torpid, though its appetite was undiminished. It was kept until December, when, its recovery appearing hopeless, it was killed. A necroscopical examination showed that all the abdominal organs were healthy, with the exception of the liver and pancreas, on the surface of which were observed transparent vesicles similar to those of the pig Measle. The liver had two of these on its right lobe ; they were about the size of a large pea, lay beneath the peritoneum, and had made a depression in the organ. Those on the pancreas were five in number ; they were on its upper border, but had not affected the structure of the gland. The thoracic organs were healthy. On opening the cranium, the meningeal membranes were found to be very congested ; in the upper and lateral parts of the right lobe of the cerebrum were four elevations, corresponding to four hydatid-kysts covered by the arachnoid, and lying in depressions in the cerebral tissue ; in the left lobe only one was discovered. The hydatids were carefully examined by M. Mégnin, a veterinary surgeon who has made helminthology a special study, and they proved to be identical with those of the pig Measle.

The dog had doubtless obtained the ova from eating human excrement, as this animal is sometimes apt to do.

Siedamgrotzky, of the Dresden Veterinary School, in the report of that establishment for 1871, cites an analogous case. A large-sized dog, always apparently in good health, was suddenly seized with cramp and convulsions, especially of the jaws. In a short time it was unable to stand ; the pulse and respiration were much quickened, the head hot, and the conjunctivæ injected ; considerable prostration was present. By starts, it would jump up spontaneously, run forward until it met some obstacle, push hard against it, and bark for half an hour at a time ; then it would lie down, convulsively champ with its mouth, from which saliva would flow, and remain in a state of coma. It died on the evening of the day on which it showed these symptoms. On examination, the brain, and more especially its envelopes, were found greatly congested ; in the superficial part of the two hemispheres of the cerebrum, were found twenty-three cysticerci, each about the size of a pea ; they were enveloped in a thin white kyst of connective tissue, around which the proper texture of the brain appeared redder than usual, and a little softened. Nothing abnormal was observed in the other organs.

COURSE AND TERMINATIONS.

The disease occasioned by the parasites is generally chronic in its course, and more especially if they are not present in large numbers. Pigs whose tissues are invaded by them a few days after birth, may live until they are two years old without their growth being interfered with; when they have been well fed before and after they are made to swallow the proglottides, they may even fatten. But, as a rule, such animals grow but slowly and do not thrive; they are stunted and weedy, though they may live for months, and even for one or two years. As has been stated, the course of the disease will depend upon hygiènic conditions, but still more upon the number of ova ingested and the organs invaded. So that only a few days may elapse after swallowing these, before the most serious symptoms appear and rapidly terminate in death; or the pigs may survive for as many months before they succumb.

In mild cases the malady is not necessarily fatal, as the parasite may pass through its metamorphoses in the body of the pig, and having become completely enkysted, will cause no further injury, and may undergo a process of calcification.

PATHOLOGICAL ANATOMY.

The lesions found after death are due to the cysticercus, which is found in the subcutaneous connective tissue, and in that of many organs, particularly where it is loose and abundant. In the interstices, and between the fasciculi of the muscles: though not so frequently in those which are much in motion, as in the limbs; beneath, between, or upon the serous membranes in various regions; in the texture of the heart, lungs, liver, spleen, kidneys, and in or on the testicles; in the brain, plexus choroides, and spinal cord; in the chambers of the eye, crystalline lens, between the choroid coat and the retina; in and beneath mucous membranes, and even beneath the periosteum; are found the kysts filled with fluid, and contain-

ing each the rudimentary tapeworm. They may be few in number in animals which gave little or no indication of their presence before death; or they may be so numerous and closely congregated, as to completely alter the aspect of the organs or tissues.

These tissues themselves are more or less modified, according to the number of the parasites and the progress of the disease. At first they are slightly congested, but at a later period they become indurated, lose their suppleness and elasticity, assume various hues, are of different consistencies, and at some points have a stony hardness; or they submit to fatty degeneration. The lymphatic glands are enlarged, softened, and infiltrated; the lungs are of a deep-red hue, and indurated here and there; the liver is dark, increased in volume, and has likewise hardened patches; the mucous membranes have lost their colour, are pale, and sometimes ulcerated, especially that of the colon; there is general paleness of all the tissues, and serous infiltration into the connective tissue of the dependent parts, as well as into the abdominal and thoracic cavities; the muscles are blanched, softened, and without cohesion, and the fat has lost its consistency. The blood has scarcely any clot, and contains from eighty to ninety per cent. of serum.

Sometimes the cysticercus perishes in its capsule, the fluid surrounding it becomes inspissated to the consistency of coagulated albumen, and in time is almost calcareous.

DIAGNOSIS.

If the kysts are not visible at the commencement of the malady, the diagnosis is not certain until it has made some progress.

The kysts should be carefully looked or felt for, towards the sides and frænum of the tongue; if they are not perceptible there, the eyelids should be everted to examine the conjunctivæ, and the anus may also be inspected.

If they cannot be discovered in these situations, then the disease will not be positively distinguished until it has made more

progress. If, however, the malady has been prevalent in the locality, or if it can be ascertained that the suspected pig has swallowed the proglottides of the tapeworm, then there is a strong presumption that Measles is present.

In some cases the disease can only be certainly recognized after death; but it might be advantageous to extract a portion of muscle with Kuhne's flesh-harpoon, and examine it microscopically.

VITALITY OF THE CYSTICERCUS.

It is extremely probable that the ova and hydatids are endowed with considerable vitality when exposed to such natural influences as the sun, air, cold, and moisture. They withstand a temperature of 95° to 122°, but perish when exposed to 170° for some minutes. Long exposure to a low temperature also kills them, as does also salting for a long period; hot fumigation or smoking for twenty-four hours will also destroy them, but they will resist cold smoking, or slight salting, for three days.*

* We possess no definite knowledge as to the vitality of the cysticercus. Some naturalists have imagined that all similar entozoa perish very soon after the death of their host, and that it is impossible that animals eating their flesh can become infested with them. Baillet, of the Alfort Veterinary School, has, however, experimentally proved that this is an error, and has demonstrated that the *Cysticercus tenuicollis* may still become transformed into a tapeworm in the dog's intestine more than twenty-four hours after the death of the ruminant which harboured it; that the scolex of the *Cœnurus serialis* will develop into a tapeworm eighteen to twenty-four hours after the rabbit, in whose connective tissue it has been found, has perished; and that in the omentum or mesentery of rabbits which has been laid out on straw in the open air for eight days, the *Cysticercus pisiformis* has been found, certainly to all appearance dead, but it was promptly restored to activity by plunging it for a few minutes into water at a temperature of 104° to 122°.

Küchenmeister gave a number of the hydatids of the pork Measle to a condemned criminal at different periods before the day of execution, and forty-eight hours after death discovered *Tænia* in various phases of development; those which he had last given, however, were not to be found, and he attributed this to the fact that they were dead before being administered; for, he says, "I have never succeeded in converting into *Tænia*, cysticerci which have been procured three or four days after the death of their host."

MODE OF INFECTION.

It appears to be clearly ascertained that the pig is primarily infected from the human species, and that it usually finds the germs of the parasites in the matters expelled from the intestines of persons who have tapeworm. When tapeworm is prevalent among people in a certain region, and the pigs therein are not properly attended to, we may expect to find Measles a common disease, and measly pork a fertile source of infection of other animals and people yet unaffected, or partially so.

MODE OF ACCESS.

We have no evidence to prove that the parasites gain access to the body of the pig otherwise than by the mouth and stomach, if we except the transmission from the infected sow to the fœtus *in utero*. At the Alfort Veterinary School, healthy pigs were kept for a long time in the same habitations with those which were diseased, and remained unaffected.

INCUBATION.

The experiments hitherto conducted on the pig have not served to determine the time necessary for the ova to attain their larval development in its tissues. It would appear, however, that, after ingesting the ova, the period that elapses before the hydatid is enkysted is about two and a-half months. Leuckart gave four cysticerci of the pig to a perfectly healthy young man, and in three and a-half months afterwards, he voided two tapeworms on receiving a strong tænifuge draught.

EXTENSION.

Among the porcine tribe the malady is extended by the distribution of the ova contained in the segments of the human tapeworm (*Tænia solium*): these being deposited with the fæces in places accessible to pigs, where they are devoured by these animals, or are washed into the water they may drink. The malady is extended among the human species by consuming the raw or imperfectly cooked flesh of pigs which were the hosts of the parasite. By means of this flesh

tapeworm may become widely extended, or appear in regions where it was before unknown.

Sewage, unless it is carefully prepared before it is spread over the land, might assist in extending the malady.

MORTALITY AND LOSS.

We are not in a position to make any reliable statement with regard to the mortality and loss caused by the hydatid in this country. It is very probable that the disease is much more common than is suspected, for there is no proper meat inspection; and as soon as a pig is observed to be sick, it is killed and sold for food. In Ireland, it has been supposed to affect about six per cent. of the porcine population; but this is probably much below the truth. The malady is far from being rare on the Continent; and, according to Delpech, it is wide-spread in the middle of Western France—in Normandy, Picardy, Lorraine, Gascony, and Dauphiné. A farmer in the Gard Department informed him that the proportion of leprous pigs was seven to eight per cent.

The disease is sometimes very fatal, especially when the pigs obtain the ova in large quantity and repeatedly.*

IMMUNITY.

Aged or fully adult pigs are but little susceptible to the invasion of the parasite: probably because their textures are not favourable for its metamorphoses. Experiments with pigs more than a year old have yielded only negative results; under that age, however, there is extreme susceptibility, and even the fœtus is not exempted.

SANITARY MEASURES.

The sanitary measures necessary for the prevention of the disease in the pig are those of a hygiènic kind. To keep it free from the parasite, care must be taken that the food given to it does not contain any proglottides of the mature worm, and that it is not allowed to frequent places where these are

* A fatal outbreak among pigs in Algeria is alluded to in the *Bulletin* of the Central Veterinary Society of Paris for 1874 (page 141).

likely to be deposited. When tapeworm is known to prevail in a locality, this precaution is still more necessary; pigs should not be allowed to stray, but be kept in clean, dry dwellings, and most carefully fed. As pigs cannot become affected unless they swallow portions of the human tapeworm containing the germs of the parasite, the preventive measures are sufficiently indicated. At the same time, the sanitary authorities should take precautions against pigs of a vagabond disposition ingesting dangerous filth, by forbidding the deposition of human ordure in any but proper places, to which pigs cannot have access; and where it may suffer such decomposition as will effectually destroy any parasites, or be treated so that, if employed as manure, it may not contain living germs.

CURATIVE MEASURES.

We do not know of any agents or method of treatment which will destroy the parasite when it is lodged in the tissues of the body. In early times the kysts which are visible were opened by men practised in the operation, and this was thought to cure the disease. It is needless to say that it was no more successful than the barbarous practice of "worming" the dog's tongue to prevent it becoming rabid. If treatment were resorted to immediately after the pig had ingested the germs, then powerful tænifuges might destroy these; otherwise there is but little prospect of harming them. When the malady is suspected, and it is decided to keep the animal alive, hygiènic measures—cleanliness, good food, exercise, fresh air, and tonic medicines—may be adopted. Or repeated small doses of carbolic acid administered internally, with weak solutions of the same substance rubbed into the skin over the regions most frequently invaded, might be tried. As a precautionary measure, however, in the interest of mankind, it is better, when the disease is unmistakably present, to kill the animal, and either bury the carcass, or utilize it in such a way —as by sending it to the soap-boiler—as will not endanger the health of people.

USE OF THE FLESH OF MEASLED PIGS AS FOOD.

The carcasses of measled pigs should not, if possible, be utilized as food, even when the hydatids are apparently few in number. Thorough pickling or smoking, and cooking at a temperature of 212°, will destroy the vitality of the measle-worm; but this is rarely effected, as there is generally great carelessness in preparing and cooking such food; indeed, among the lower orders of some countries, pork is eaten raw. The danger of such an uncivilized habit is great; and, indeed, with the greatest care in cooking, safety cannot always be guaranteed. Long-continued and strong salting, or smoking, may kill the parasite; but it must be remembered that such flesh does not take readily to salt, and that it is most difficult to smoke such large masses as hams so thoroughly that the deeper parts will be sufficiently penetrated. The more modern method of curing hams and bacon by dressing them externally with some empryeumatic substance, is even less reliable than the old-fashioned one of smoking.

If such flesh must be used, it should be cooked in thin pieces, and at a high temperature, for a sufficiently long time, to ensure the complete destruction of any parasites it may contain.

The inspection of pork in the slaughter-houses and butchers' stalls should be scrupulously carried out, and people who purchase such food should themselves be able to distinguish whether it is diseased.

Unscrupulous butchers, who deal in unsound flesh, resort to various measures to render measly pork marketable. The principal of these is carefully dissecting out the bladder-worms and those parts which are infiltrated, and reddening the flesh with the blood of another animal. A new section, however, will expose this deception. Indeed, the pig-dealers themselves resort to fraud in order to dispose of diseased animals. As we have said, in the great majority of cases, the only visible symptom of the malady, when it has reached a certain stage, is the presence of the vesicles at the base of the tongue and inside the eyelids. The dealers destroy these vesicles with

a knife or scissors, and feed the pigs on milk the day and morning previous to exhibiting them for sale. This practice is common in Germany and France ; in the latter country, and particularly in Limousin, it is known as *épinglage*, probably from a pin being sometimes used to open the vesicle.

Measly pigs are usually converted into bacon and hams, or their flesh is made into sausages as quickly as possible.

The presence of the hydatid is, of course, the characteristic feature of Measles, and without its presence the existence of the disease cannot be proven. Such flesh, when much infested by hydatids, does not keep so long as that of healthy animals, and when put into boiling water, it floats for some time, only sinking when it has furnished an abundant scum. The water in which it is boiled is dirty-looking, insipid to the taste, and odourless ; consequently, it has but little nutriment. The flesh itself is reduced to a very small bulk; it is pale, and between its fibres the cysticerci are recognizable by their white hue, their friability, and their crunching under the teeth, owing to the calcareous matter they contain. When this flesh is being roasted or fried, it emits a crackling sound, due to the bursting of the kysts ; and it gives the same gritty sensation between the teeth as when boiled.

In the earlier stages, or in mild attacks of the disease, the flesh may not prove injurious when properly cooked ; though it cannot be so nutritious or savoury as healthy flesh. When, however, the parasites are numerous and have caused serious disturbance, it is so disagreeable and innutritious that its use should not be tolerated on any account, even when it is thoroughly cooked. In this state it has been reported as occasioning Diarrhœa, and symptoms of Scurvy, in delicate persons who had consumed it for several successive days.*

* We know not whether it was the fear of tapeworm or some other disease, or whether it may have been the bad quality of the flesh of measly pigs, that caused pork to be looked upon with such suspicion in the Middle Ages. It was most probably the latter ; for we have no evidence to show that tapeworm was suspected in consuming such food. That tapeworm and pig Measles must have been very common, might be inferred from the filthy habits of the people in those days ; when water-closets were un-

It is the safest course to interdict the use of this flesh altogether as food, but to allow the skin to be utilized by the tanner, and the carcass by the soap-boiler.

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known, and latrines were open sheds, or were not even deemed necessary. The wandering pigs must have been greatly infested by the parasite, as they had every opportunity of devouring the proglottides, and were kept in much the same way as they now are in the towns and villages of North China.

However this may be, it is certain that leprous pigs were regarded with much apprehension in this country and on the Continent. In the middle of the thirteenth century, during the reign of Henry III., there appears to have been a panic with regard to the flesh of these animals, as laws were enacted to prevent that which was measled (*porcinas supsennuates*) from being sold. In France, in 1350, King John issued a similar edict, which was carried out by the police in Paris. King Charles VI., not long after, and with him the provosts of Paris, established *visiteurs jurés* to ascertain the condition of pigs with respect to this disease. Even in the last century, the dread of leprous pork was still great; and Louis XIV. was constrained to appoint officials who bore the title of *Conseillers du roy, Jurés langueyeurs de porcs*, whose functions were to ascertain by an inspection of the tongue of pigs, whether these animals were affected with Measles. It was probably through their instrumentality that the Chamber of Justice, in 1710, condemned Antoine Dubout, director of slaughter-houses for the king's army, to do penance in the public streets, wearing nothing but a shirt, with a rope round his neck, a lighted red-wax taper weighing two pounds, in his hands, and carrying behind and before him a placard on which was inscribed the words: *The director of slaughter-houses, who issued leprous flesh to the soldiers.* He was also condemned to be banished for nine years from the seat of government, the places where camps were formed, and from all garrisons and armies of the king. In addition to this very severe punishment, he was prohibited from having anything to do with slaughter-houses, and ordered to pay a fine of fifty thousand pounds to the king. The pains and penalties for selling, or countenancing the issue of, this measly pork appear to have been very severe.

MEASLES IN THE OX.

SYNONYMS—Technical: *Cysticercus bovis, Cestode tuberculosis.* English: *Beef-measle.* French: *Ladrerie de bœuf.* German: *Blasen-wurm des Rindes.* Hindostanee: *Jowa.*

GEOGRAPHICAL DISTRIBUTION.

This parasitical disease of the bovine species is, in all probability, like the analogous disease of the pig, known in countries where a particular kind of tapeworm is present in the human species. It is therefore most likely a wide-spread affection, its prevalence in a country more or less depending upon the sanitary conditions of that country. The tapeworm itself is common in India (about eight per cent. of the European and native inhabitants of the Punjab are so affected), as is the parasite in cattle; in Upper Egypt and Abyssinia it is endemic, as well as in Hungary (particularly among the cattle of the Danubian Principalities) and Algeria. It is more than probable that it will be found in every quarter of the globe; for though both the hydatid and the tapeworm have been experimented with and described by Leuckart, Mosler, Röll, Gerlach, Zürn, Cobbold, and others, for some years, yet the range of the bovine affection is not well ascertained. Except in the Indian bazaars, where measled beef has been very often found (and particularly in the Punjab, where the cyst is known as "jowa," and the Mussulman population is infested with *Tænia mediocanellata*), and in a great many instances among Hungarian cattle, the *Cysticercus bovis* has been chiefly witnessed in those cases in which the proglottides of the adult parasite have been experimentally administered. At Vienna, Röll has, on several occasions, minutely examined suspected beef, but without discovering the cysticus,—though he has no doubt that it does exist in the cattle slaughtered at Vienna, as this tapeworm is that which is

most frequently met with in that city. It is the same at Florence.

In England, the beef Measle must also be far from rare; for according to Cobbold, whose experience as an helminthologist has been very great, this form of tapeworm is much more frequent as a human guest than the *Tænia solium* derived from the pig.

CHARACTER.

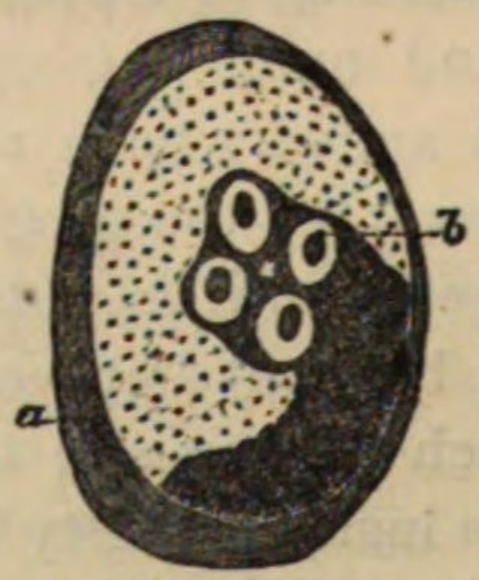
The disease belongs to the same class as the preceding, and is characterized by the presence of hydatid kysts in similar regions, viz., the muscles and internal organs.

NATURE.

Like the pig Measles, this is also parasitic, the entozoön being the larval cestode of the *Tænia mediocanellata:* a human tapeworm infesting the small intestine. It is special to the bovine species, as the proglottis of this worm administered to pigs, sheep, and other animals, has not produced the disease in them. The tapeworm presents several specific difference from that of the *Tænia solium.* It may be described as follows :—Very long, wide, and thick ; no hooks on the head, which is comparatively large, flat, dark-coloured, and usually inclined to one side of the neck ; the rostellum is very slight, or altogether absent ; the suckers are large and usually surrounded by a dark ring ; neck short, but longer than that of the *Tænia solium,* according to Davaine, and the calcareous corpuscles are larger and more numerous than in the latter ; the posterior segments are very wide and short ; the genital openings irregularly alternate ; the proglottis very large (from three to five times longer than it is wide) and vivacious, often escaping from the anus by itself between the periods of defecation, and causing much uneasiness ; the uterus has a great number of divisions—as many as thirty on each side ; the ova or ovules are more oval, smooth, and transparent than those of the *Tænia solium :* consequently the embryo is more easily perceived. A worm about thirteen feet in length numbers, according to Cobbold, something like twelve hundred segments or joints, each of which is capable of developing in its interior

some thirty thousand eggs. "Consequently, if all the joints of such a worm," says this authority, "should arrive at perfection, they would collectively afford a total of more than thirty millions of ova. It is not usual, however, to find at one time more than seventy or eighty of the joints full of perfectly ripe eggs. On the other hand, it must be borne in mind that, as during life the ripe segments are cast off at the rate of about four hundred per month, any one person who is playing the part of host to this worm is liable to be the means of dispersing abroad upwards of one hundred millions of these eggs annually."

When a young or full-grown ox swallows the mature living ova, this passes through the same metamorphoses as the ova of the cysticercus do in the pig: boring its way through the walls of the intestines, passing into vessels, and finally locating itself in various organs and textures. Here it becomes encapsuled, the capsule being formed of several layers of condensed connective tissue belonging to the organs so invaded. The process of development is carried on and achieved in this capsule, so far as the ox is concerned. In a short time after it has become enkysted, fluid begins to appear, and in this the hydatid soon begins to exhibit all the distinctive characteristics of the adult worm. The caudal vesicle is quickly developed, and imbedded in it, like the hydatid of the pig, is seen the head and neck of the parasite. According to



Encapsuled Hydatid of the Beef Measle.
a, Capsule of connective tissue; *b*, Head of hydatid. (After Cobbold.)

Leuckart, the vesicle, in seventeen days, is from —039 to —157 inch long and —039 to —118 wide, and the head has

begun to become distinct. Röll describes the head of the hydatid, when fully developed, as globular, provided with four suckers and a retractile proboscis or frontal sucker, and furnished with a single ring of caducous hooklets (six in number). The neck is transversely ridged; and the vesicle, at first spheroidal, becomes elongated, and is also ridged. The head

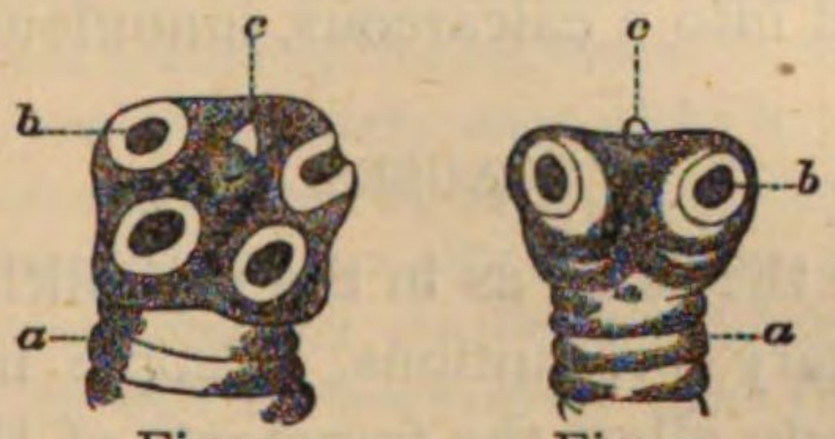
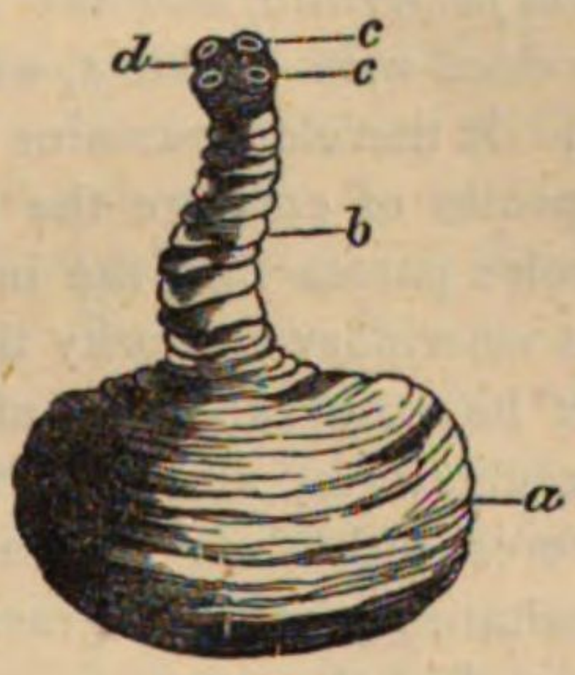


Fig. 1. Fig. 2.

Head of Beef Measle-worm.

Fig. 1, Diagonal view; Fig. 2, Side view: *aa*, Neck; *bb*, Suckers; *cc*, Retractile rostellum. (After Cobbold.)

and neck measure one and a-half to two lines, the vesicle from one and a half to four lines long, and its width half a line. According to Cobbold, when fully developed, the capsuled beef Measle does not usually measure more than one-fourth of an inch in diameter, and is therefore much smaller than the corresponding cysticercus of the pig. In a specimen which he obtained from Mean Meer, India, in 1869, in the unrolled condition it measured five-eighths of an inch from head to tail; the caudal vesicle being three-eighths of an inch in



The Ox Measle or Bladder-worm of Beef. (Magnified nine diameters.)

a, Caudal vesicle; *b*, Neck or body; *cc*, Suckers; *d*, Rostellum (or central sucker). (After Hewlett.)

breadth,—the base of the so-called neck was one-eighth of an inch in diameter.

The hydatid has now reached its full development, and remains in its capsule until it is eaten along with the flesh of the ox it has fixed itself in; when, if it has retained its vitality in the process of cooking and mastication, it soon becomes a tapeworm, the segments and ova of which pass through the same change as the parent. Or it may die in its capsule, and become converted into a calcareous, innoxious mass.

CAUSES.

The causes are the same as in the pig: filthy habits, and an absence of sanitary precautions. People infested with the tapeworm carelessly allow the fragments of these, passed with the fæces or at other times, to lie exposed in places where cattle may ingest them. In this way they may be picked up on pastures, in the pools and ponds where the ova have been carried by rain, or on manure heaps, &c.*

* We can readily understand how carnivorous animals become infested with entozoa, as the flesh they devour contain the germs of these. But it is not the same with the herbivora, as these do not consume flesh; and therefore the question arises as to how they are made the bearers of parasites, and especially *Tænia*. Some authorities have imagined that the hookless *Tænia*—as those of the herbivores are—obtain access in the water these animals drink; while others believe that at least some of the parasites are destined to submit to the same metamorphoses, and accomplish the same migrations, as those of the carnivora; for in the ova, their embryos—as in the *Tænia perfoliata*, and the *Tænia mediocanellata*, according to Röll—are provided with hooklets, which ought to serve them as organs of locomotion. It therefore remains to be determined, as Baillet remarks, into what species of creature the proscolex first penetrates, and how the resulting scolex passes into the intestine of an herbivorous creature. This excellent veterinary authority thinks that it is not impossible that the proscolex has the capability of living at first in certain insects or other inferior creatures, and that these may be accidentally swallowed by the herbivores with their natural food; as Colin has remarked that cattle unhesitatingly eat the grasshoppers which devastate the pastures towards the end of the summer.

Such an explanation is scarcely necessary with regard to the causation of the beef Measle, as an Indian authority on this subject, Dr. Fleming, writes to Professor Cobbold in the following terms:—"I have been an eye-witness to the disgusting spectacle of cattle eating greedily the fresh human evacuations in the neighbourhood of Indian villages, and have

The human species are infected, again, by eating the raw or imperfectly cooked flesh of cattle which have become measled in this manner; and so the parasite and parasitism are maintained.*

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been told that sheep do the same thing. It is a daily occurrence in India, where pigs are plentiful, to see these animals watching the natives, in the morning especially, and devouring the excrement as fast as it is deposited. I believe the natives sometimes carry stout sticks to beat the pigs off." I may remark that I have observed this as an every-day occurrence in the towns of North China, where the pigs and dogs savagely compete as scavengers. The same observer continues:—"I look upon the dirty pools, which are placed within a few yards of most Indian villages, as the principal medium through which cattle become kyst-infected. The customs of the natives, the low level of these pools, the periodic rainfall, and other circumstances, tend to localize the parasitic ova in certain places, and thus it is impossible for the cattle to avoid swallowing the eggs while seeking to allay their intense thirst." Another observer, in the Punjab, states, that in his district the camel-drivers are notoriously dirty in their habits, and are not unfrequently infested with *Tænia mediocanellata;* and also that "human filth was often to be seen on the banks of the tank, and the microscopical examination of mud and stagnant water, taken from the margin, exhibited tapeworm ova."

* Among people infested with this variety of tapeworm, the custom of eating the raw or undercooked flesh of cattle must tend to the perpetuation and extension of the parasite, and more especially when their habits are filthy. Thus among the Abyssinians, who eat the uncooked flesh of cattle, tapeworm is endemic—so much so, in fact, that we are gravely informed that these people view it as essential to their well-being and happiness, and that if no tapeworm joints are expelled it is a serious matter. It is usual for the purchaser of a slave to receive with his bargain a quantity of "kousso" to remove his tapeworm.

Leuckart states that he was informed by Dr. Kaschin, a physician in the Russian army, that the Buriats or Burates, who inhabit the Baikal region, and are Cossacks, are nearly all infested with tapeworm. They eat the flesh of cattle, sheep, horses, and camels; but they neither dress the meat properly, nor cook it completely. Indeed, fat, liver, and kidneys are eaten quite raw, and diseased animals are as much relished as half-rotten carcasses. In addition to this unpleasant propensity, they are extremely voracious. In an hospital containing five hundred of these people, and who were being treated for other affections, all were infested with tapeworm.

The Mongol and other wandering tribes, and even the settled tribes of Central Asia, consume flesh in the same careless manner; and we might, therefore, expect them to be as frequently infested with tapeworm.

We might well inquire which was primarily affected, or to which creature does the tænia belong—man or the ox?

SYMPTOMS.

The symptoms produced by the parasite during its migration and subsequent enkystment, are not unlike those presented by the pig; and sometimes a considerable degree of parasitism may take place without any very marked reaction being perceptible. As in the pig, much depends upon the number of the living ova ingested, and also whether they become located in important organs; for it is evident that a very few fixing themselves in the cranial cavity, or spinal canal, may occasion most serious symptoms.

As both hydatids appear to have a marked preference for locating themselves as near the surface of the body as possible, we may, in a number of cases, be able to discover the kysts during the life of the ox, in the same regions as in the pig, viz., at the base and frænum of the tongue, and inside the eyelids. Thus, one Indian observer says, "The largest beef Measle I ever saw was obtained from the side of the tongue, and when unrolled was about an inch and a-half in length;" and another speaks of having seen an ox at Rawal Pindee, "in which immense clusters of these kysts could be felt at the root of the tongue."

The infection may be so trifling, as already said, that the animal appears to suffer but little, if any, inconvenience; or it may be so serious as to produce a fatal result. Mosler, in one instance, caused the death of a calf by administering only a moderate quantity of proglottides (though the ova were, in all likelihood, all mature and active); and Leuckart, of two experimental animals, killed one in this way. Gerlach's experiments were not productive of any injury to the health of the animals; but Zürn, on the contrary, has seen cattle perish from the ingestion of the proglottides.

Simonds and Cobbold also nearly produced a fatal result in a calf; and as their experiment is interesting, so far as the symptoms are concerned, we will take it as a typical case. On December 21st (1864), a healthy sucking-calf received eighty mature proglottides of the *Tænia mediocanellata* in a little

warm milk, and was watched every day. Sixteen days afterwards (January 6th), an attentive examination showed that, though lively and feeding as usual, it was nevertheless suffering from some persistent cause of irritation: evidenced by often biting at the legs and other parts of its body, and trying with its mouth and tongue to get at places which were beyond its ordinary reach. It would also frequently rub itself against the manger and sides of the loose-box in which it was confined. Desisting from this, it would arch its spine and stretch out its hind limbs in an altogether unusual manner; it would also strain itself repeatedly, at such times voiding either urine or fæces, or occasionally both in small quantity. There was no expression of suffering in the countenance; no disturbance of the breathing or of the circulation; no injection of the visible mucous membranes; no alteration of the temperature of the body; nor any other serious manifestation. On the fourth day, the signs of irritation had completely disappeared. On January 25th, five weeks after the first administration, two hundred more of the mature proglottides were given; but one-half of these had been immersed in alcohol, so that they were probably inert. The joints were given as before in the form of draught, and but little force had to be employed to make the calf swallow them. Immediately on being released, however, it was observed to exhibit symptoms of distress in breathing, and trembled much. This continued for some time, and next morning, though the tremors had somewhat abated, the animal was dispirited and ground its teeth as if in pain; the appetite was also much diminished. On the succeeding day, however, all these symptoms had passed away, and the calf looked as usual. On February 1st, there was a decided return of the irritation, but in a day or two this again passed away: though the animal's coat was unhealthy-looking, and there was evident loss of flesh. On the 8th, the calf was dull and dispirited, refused all food except a little milk; it arched the back frequently, and stretched the limbs in a peculiar manner; the breathing and pulse were increased, and slight tremors were observable, more especially of the muscles of the neck and shoulders.

On the following day these symptoms were more marked,

and on the 10th the animal was so ill that a fatal result was feared. On the 11th, however, it was better, but the muscular tremors persisted. A small portion of the right sterno-maxillaris muscle was removed for examination; and this, although it weighed only twenty-two grains, exhibited three imperfectly developed vesicles, each about the size of a pin's head; there was no trace of calcareous corpuscles or head. The animal was still improving on the 12th, but it was dull, and the pulse and breathing continued quicker. On the following day the tremors had disappeared, and on the 22nd all the morbid symptoms had vanished. Until the beginning of April the calf continued to maintain good health, and gained flesh so rapidly that at this time it might have been sold as a "thoroughly sound and thriving young beast." It was killed on the 3rd of this month, and its particularly healthy aspect was generally remarked, "there being no external indications by which the most practised professional eye could have discovered the existence of internal disease. But for our previous trial, we should ourselves have been doubtful of finding any entozoa within the flesh."

This affords us, perhaps, a fairly accurate estimate of the symptoms produced by the parasite when it does not locate itself in any very important organs—such as the brain or spinal cord. It is very likely that the symptoms, as a whole, do not differ much from those manifested by the pig, and may all be referred to the organs or textures invaded by the hydatid, the period of greatest disturbance corresponding with the migration and enkystment of the cysticercus; though, as in the brain or eye, functional derangement may persist, or even increase, after it has become encapsuled. It appears to be fully ascertained that an immense amount of muscular parasitism may take place in cattle, without producing any very alarming or fatal effects.*

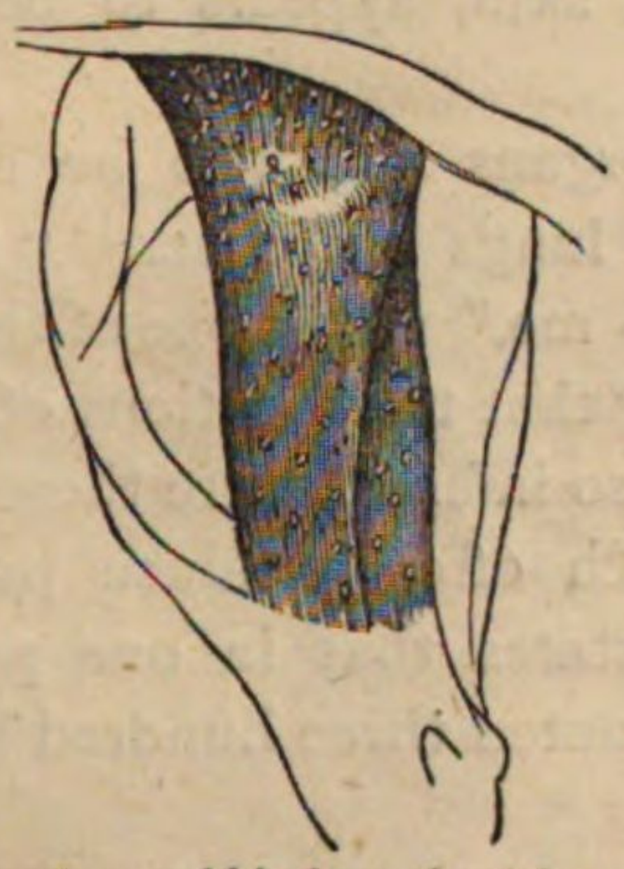
* In the *Veterinarian* for May, 1874, I have described some recent experiments of Professor Saint-Cyr, of the Lyons Veterinary School, with the proglottides of the *Tænia mediocanellata*. In two calves experimented upon, lingual kysts were observed soon after the ingestion of these: in one of them in nineteen days.

COURSE AND TERMINATIONS.

We know little of the course and terminations of Measles in the ox when natural infection occurs, simply because the animals may sicken and die without the cause of death being suspected. The symptoms produced by the parasite may be allotted to some other better known disease, and when recovery takes place no more will be thought of it. In the case cited above, we have what may be considered the course and termination of the malady when the muscles are chiefly involved; and it is not unlikely that this is more frequent than is generally believed. When important and vital organs are implicated, then a serious termination may be anticipated. When the animal recovers, the hydatid may maintain its vitality in the capsule for a number of months, but it will eventually perish, and calcareous degeneration set in. This may occur within six or eight months.

PATHOLOGICAL ANATOMY.

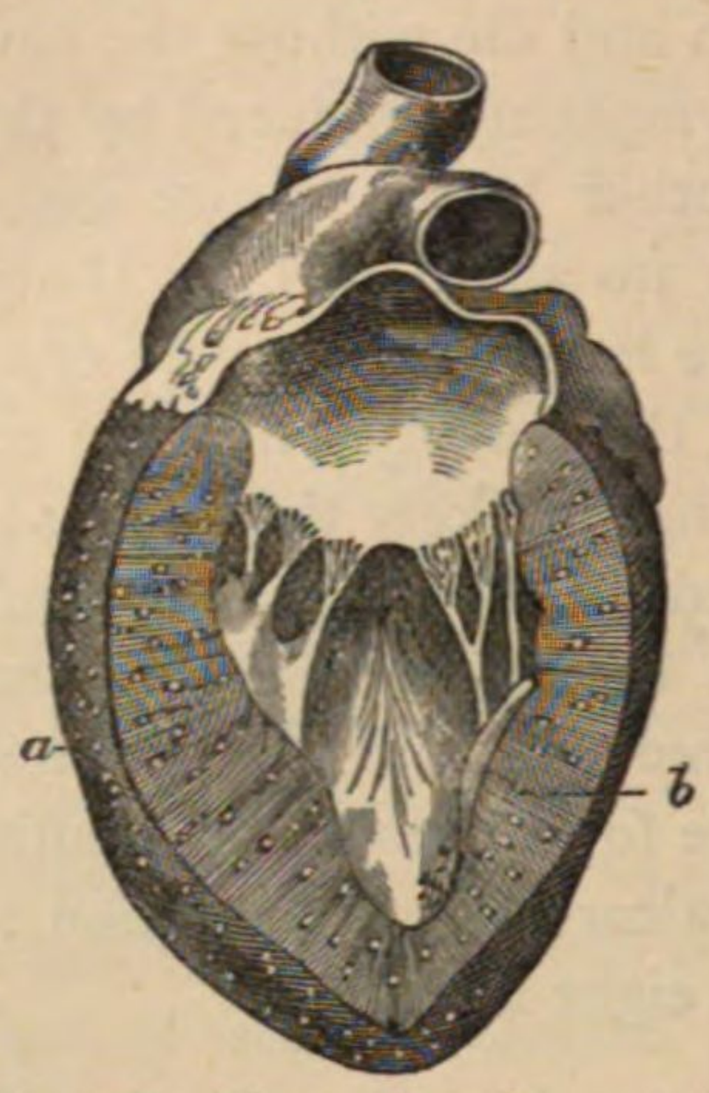
This is somewhat similar to what is observed in the pig. The more superficial muscles are chiefly affected—the panniculus, and those of the shoulder, breast, loins, and hip or



Muscles of hind quarter of a calf infested with cysticerci, which appear as small white points. (After Cobbold.)

quarter, being most involved. The diaphragm, muscles of the abdomen, tongue, neck, face, and eyeballs, may also be

largely occupied by the little kysts. In the texture and on the surface of the heart, they are also found more or less abundant; though the vesicles are generally smaller than elsewhere, and the hydatid less completely developed.



Heart of a calf infiltrated with cysticerci: *a*, external surface of the organ; *b*, cut surface. (After Mosler.)

In the muscular system the kysts lie parallel with the fibres. The connective tissue in the interstices of the muscles, as well as beneath the skin, appears to be rather a favourite location.

Various internal organs may also be extensively involved, and particularly the lungs and liver. "It was frequently a matter of surprise to me," writes one of the Indian authorities already mentioned, "that the functions of the lungs and liver could be carried on, so infested were these organs with hydatids and flukes which often produce profuse suppuration." The same observer states that in one pound weight of the psoas muscles, he counted three hundred living cysticerci.

DIAGNOSIS.

The diagnosis of this disease, while the animal is alive, must be difficult, unless from various circumstances the presence of the cysticerci is suspected. An examination of the tongue

and eyelids may then be useful; or by extracting a morsel of muscle from the breast or hip with the flesh harpoon and examining it, the parasites may be discovered by means of the naked eye, a pocket lens, or the microscope.

VITALITY OF THE PARASITE.

We know almost nothing of the vitality of the bovine cysticercus, but it is probable that it is not so tenacious of life as that of the pig. Though it and its ova may resist for a certain time the action of natural agencies, yet it appears to be ascertained that a temperature of 140° will kill it. After it has attained its full larval development, it probably does not live longer than from four to six months in the textures it has invaded: becoming after that time so degenerated as to be incapable of further development.

MODE OF INFECTION.

Infection takes place through grazing, drinking water, or ingesting the fæces of people in districts where *Tænia mediocanellata* prevails, and no sanitary precautions are adopted.

MODE OF ACCESS.

The only known mode of access of the parasite is by the digestive organs.

INCUBATION.

From the reception of the ova until the appearance of the earliest symptoms, there may elapse an interval of from a fortnight to a month. When the hydatid is transferred to man, it becomes developed into a tape-worm in two and a-half to three months.

EXTENSION.

The disease can only be extended by an utter neglect of all sanitary precautions, and the filthiness of people affected with tape-worm. Its prevalence and extension must, therefore, depend upon the habits of the people.

MORTALITY AND LOSS.

For the reasons already stated, there are no means of arriving at an estimate of the mortality or loss from the presence of the parasite in cattle. In some countries, the extent of the disease must be very serious. In India, for instance, it must not only be a source of loss, so far as the flesh is concerned, but of great danger to those who eat such food. One authority asserts that he scarcely ever inspected the body of a slaughtered ox or cow without finding either hydatids in the lungs or liver, or cysticerci in the muscles. In 1869, out of 13,818 head of cattle slaughtered in the stations of the Upper Punjaub, 768 were affected with kysts, or about 5·55 per cent. In 1868, it was 6·12.

IMMUNITY.

It is possible that young animals, as calves and heifers, are more susceptible to infection than old beasts; and it is also pretty well ascertained that after six or eight months, if no ingestion of ova has occurred in the meantime, the flesh of infected animals, though charged with kysts, is innocuous, as they have lost their vitality. There is nothing, however, to prevent a new invasion, should the animal obtain access to the proglottides, or swallow the ova in the water it may drink. In this way there may be repeated attacks, each, in all likelihood, more severe than its predecessor.

SANITARY MEASURES.

The sanitary measures for the prevention of *Cysticercus bovis* must be the same as for the *Cysticercus cellulosus*. Prevent cattle from grazing on pastures or drinking from ponds which are likely to contain the ova of the tape-worm, and particularly when it is known that the people in the district are infested with the *Tænia mediocanalleta*. Cattle should not be allowed to frequent places where human ordure is laid; neither should people be permitted to deposit their filth where it may become a source of danger. Such deposits ought to be accumulated in proper enclosures; and before being used as manure,

they may be treated with carbolate of lime, sulphate of iron, or any other substance which may destroy the ova.

Careful inspection of flesh in slaughter-houses and butchers' stalls is also necessary.

CURATIVE MEASURES.

The curative measures must be analogous to those adopted in the case of the pig Measles. Carbolic acid in small and frequently repeated doses, with tonics and stimulants, should prostration set in, will be most likely to prove beneficial. The topical application of carbolic acid might also be attended with benefit, seeing the tendency of the parasites to localize themselves in the superficial muscles.

USE OF THE FLESH OF MEASLED CATTLE AS FOOD.

The same remarks are applicable with regard to the use of this flesh as have been made with respect to that of measled pigs. It should be interdicted as food; but when necessity demands that it must be so utilized, it should then be subjected, in small pieces if possible, to a temperature of 212°, until it is thoroughly cooked.

The other transmissible entozoa of the domesticated animals cannot be noticed here, as they more properly belong to a special treatise on helminthology than a work on sanitary science.*

* The sheep appears to be infested with the larva of a human tapeworm (supposed to be the *Tænia tenella*); this hydatid resembles that of the pork-measle, but we have no evidence of its being at all common. The symptoms it may produce in the sheep have not been noted; and, altogether, it is not of sufficient importance at present to require further notice here.

PART THE FOURTH.

INSPECTION OF SLAUGHTER-HOUSES.—INSPECTION OF MEAT.—INSPECTION OF MILK.—INSPECTION OF HORSE SLAUGHTER-HOUSES.

INSPECTION OF SLAUGHTER-HOUSES.

IMPORTANCE OF SLAUGHTER-HOUSES.

In thickly-populated countries in which the larger domesticated animals are consumed for food, and especially in towns, certain establishments must be allotted for the purpose of killing them and dressing their flesh, previous to its being sent to the butcher's-shop or stall, where it is sold to the public. These establishments—slaughter-houses, or *abbatoirs*, as they are designated—are of great importance in a sanitary and utilitarian point of view, and for many years have attracted a considerable amount of attention from several of those authorities who have devoted themselves to the study of sanitary science.

ADVANTAGES OF PUBLIC OVER PRIVATE SLAUGHTER-HOUSES.

Until within a comparatively recent period, these were entirely private establishments, and were subjected to no supervision or control; in very many places they are yet so. As such they were, and are, most objectionable in every respect. Often situated in the most unhealthy and over-crowded localities, and kept in the filthiest condition, they immensely increase the general insalubrity, especially in hot weather; and they are not only utterly unsuitable for the purpose to which they are devoted, but are often places where every kind of fraud

is perpetrated with regard to diseased or objectionable flesh, and where the most horrible cruelty may be, and, it is to be feared, only too often is, inflicted on the creatures driven into them to be slaughtered. The abuses connected with these private slaughter-houses have been for a long time so glaring and serious, that the most enlightened governments have recognized the necessity of instituting public establishments in suitable and convenient localities, where not only would the sanitary condition of the neighbourhood be uninfluenced, but a guarantee would be afforded that the animals slaughtered were in a healthy state, and not subjected to ill-treatment before they were killed. In these public slaughter-houses, inspectors appointed by government or the authorities of the district, town, or city, in which they are situated, can certify to the condition of the animals both before and after slaughter, and see that they suffer no neglect or cruelty at the hands of the butchers ; while the buildings themselves should be constructed on the best principles, afford every facility for the purpose for which they are intended, prove a boon to the public and the butchers, and while not depreciating the animals in health or condition, should spare them the hardship and pain they now suffer so frequently in the private abbatoir.

ESSENTIALS OF A PUBLIC SLAUGHTER-HOUSE.

In describing the essentials of a public slaughter-house, it is scarcely necessary, when speaking of the inspectors, to state that they should be competent and trustworthy veterinarians, independent of those who use the building, and be paid a fixed salary by the authorities.

Situation of Public Slaughter-houses.

The situation of public slaughter-houses must depend very much upon circumstances connected with convenience in receiving animals, and distributing their flesh after they have been slaughtered. It may sometimes be convenient to allow them to be erected in the suburbs of a town or city : where they are, of course, least objectionable, so far as the public health is concerned ; but when properly constructed and maintained, they may be situated in the centre of large towns

and give no cause for complaint. Their proximity to cattle-markets, principal lines of railway or railway centres, or sea-ports, is an important object. Another matter for consideration is an abundant water supply of good quality, and the means for getting rid of it when it is done with,—as this is not only necessary in preserving the cleanliness of the slaughter-house, but also for dressing the flesh and preparing some of the products of the animals killed therein.

General Arrangements.

If there is not a cattle-market in the vicinity, a slaughter-house should have a large space or courtyard allotted for the purpose, where animals for slaughter should be sent for sale. This court should be accessible to the surrounding districts by a road leading round the town, in order to obviate the danger, inconvenience, and hardship to the animals oftentimes incurred through having to drive them along narrow or crowded streets. It should also have a line of rail to the railway station to which cattle are conveyed; as well as facilities for lodging the unsold animals, such as lairs and pens.

The buildings for the officials connected with the slaughter-house should separate this courtyard from the slaughter-house proper. Here also should be the places for the reception of the animals from the market—cattle, sheep, and pigs. These places should be roomy, well ventilated, and kept very clean. The time should be fixed by regulation during which animals may be retained in them; and care ought to be taken that in this interval food is regularly supplied, as butchers are generally averse to feeding the animals they are to slaughter. Forage barns may, therefore, be useful adjuncts. In some Continental abbatoirs there is a yard planted with trees, and in communication with the habitations, where the animals are watered, and where they may be exercised and inspected while alive. There should be a special stable or shed for sick animals, or for those whose state of health is doubtful, and which, therefore, require supervision.

There should be several places for the actual slaughtering, to prevent crowding, inconvenience, and delay. Special

slaughtering places should be provided for pigs, and even for sheep.

Each of these buildings should be divided into a certain number of compartments properly flagged, with a stone wall of a particular height, provided with a water-tap, a depression in the middle of the floor to receive the blood, and an arrangement of hooks, pulleys, and windlasses to raise and fix the carcasses, and benches, &c. All the tables and benches should, if possible, be of hard, close-grained stone. All the utensils and instruments necessary for slaughtering and dressing animals should be provided by the butchers or slaughtermen. Everything in these slaughtering compartments should be kept in the best and cleanest condition; the walls and floors should be cleansed once a day at least, and no blood allowed to accumulate; the intestines should be emptied in speçial places, and the offal also removed to places set apart for it.

The inspection of the carcasses should be made in these compartments, and everywhere there should be good ventilation. To keep them cool and prevent the sun's rays entering, it is necessary either to give them a northern aspect, or, if the entrance is towards the south, to have the roof in front projecting sufficiently to keep the interior in the shade. A draught of cool air is, above all things, necessary to allow the flesh to set, and also to keep away the flies. If circumstances will permit, the carcasses should be kept sufficiently long in the compartments; or they may be removed to special buildings adapted for the purpose. In some foreign slaughter-houses, there are ice stores for summer use.

Gas is necessary in slaughter-houses, as it is frequently necessary to slaughter and dress animals during the night.

It may be useful to have places in which to prepare some of the offal before it is sent from the slaughter-house. The melting of the tallow, however, would appear to be attended with serious inconvenience, and it is generally deemed advisable to sell it in the natural condition.

Manure pits must be provided for receiving the contents of the stomach and intestines, and other matters which are only

fit for manuring the land. In many abbatoirs the blood is collected for making albumen.

Waggon and cart-sheds and stables should be provided for the use of the butchers.

PRIVATE SLAUGHTER-HOUSES.

If private slaughter-houses must be tolerated, then they should be placed under proper regulation and the closest supervision. They should receive a special inspection from the veterinary inspector, who should not only examine the carcasses he may find in them, but also the flesh in the butchers' stalls. Private slaughter-houses are largely instrumental in the diffusion of contagious diseases, and it is from them that diseased flesh is issued. It is in them, also, that abominable cruelties are perpetrated on animals, as well as violations of sanitary laws. Few of them have the necessary conveniences for properly dressing or preserving the carcasses, and, as a rule, they are badly situated and kept in a filthy state. If permitted to exist at all, they should be submitted to public control and conducted on proper principles. Private slaughter-houses ought to be sufficiently lofty and spacious, the front towards the north, and the street or lane leading to them wide enough to allow animals to pass easily. The floor should be of stone flags or paved with blocks of stone, the interstices filled with cement or asphalte to prevent infiltration into the soil beneath, and the walls should be of stone or concrete. The drainage should pass into a pit, from which it can be removed from time to time and used for farm purposes. The offal and excrement should not be permitted to remain in the slaughter-house; and all operations connected with the preparation of the offal should be carried on elsewhere, as the vapour therefrom taints and spoils the flesh. The ventilation should be good, and ample means ought to be afforded for the entrance of currents of pure cold air. A chief point in the inspection must be to see that the animals for slaughter are healthy, and that they are not badly treated before they are killed.

INSPECTION OF MEAT.

THE flesh of animals forms, with cereals, the chief constituent of the food of the population of western countries, and is recognized as an article of the first necessity; its use is largely on the increase, while every year it is becoming dearer.* Unlike many other kinds of merchandise, every one cannot readily recognize its quality and relative value; on the contrary, there are few articles which present so many different conditions as flesh, or which may so easily become the object, not only of deception, but also give rise to serious accidents. It may be very deficient in nutritive qualities; from the readiness with which it decomposes, its properties may become greatly diminished, and it may even acquire injurious properties; and certain diseases of animals may render their flesh pernicious as food, and even cause death to those who consume it.

IMPORTANCE OF THE INSPECTION OF FLESH.

From the earliest times, the flesh intended to be eaten has been submitted to a regular inspection, either by laymen or priests—most frequently the latter—with such primitive people as the Israelites. But it is only within a very few years that any attempt has been made in some countries to have this inspection conducted by scientific experts; in others,

* The consumption of flesh appears to be proportioned to the degree of activity of a people; and though, physiologically speaking, it is yet below the amount which is deemed necessary, if we take the annual average quantity consumed by each person, it is found to be somewhat large. In London, for instance, it exceeds 242 pounds for each individual; in Paris it is nearly 164½ pounds; in Berlin, it is 110⅓ pounds; and in Vienna, 208½ pounds. In France, the average consumption in 1812 was only about 33 to 39½ pounds; in 1838, it was 44 pounds; in 1852, it was 53 pounds; and at present, it is 70½ pounds. The general consumption has increased more markedly in Germany than in France, especially in the large towns, where less farinaceous food is used than formerly. Much more flesh is consumed in towns than in the country; and there is a diminution in the amount of pork, but a notable increase in beef, while veal and mutton remain stationary.

as in Britain, the task is entrusted to men—such as policemen—who, from defective education and training, are quite incompetent, and even worse than useless.

It is now generally admitted on the Continent that the inspection of flesh ought to form, among all people, an essential part of public hygiène; and that it should be entrusted to a regularly organized service, not only in towns, but also in the country.

NECESSARY QUALIFICATIONS OF INSPECTORS.

The inspectors should be well-educated and competent veterinary surgeons; as none other are fitted to discharge such functions with justice to the butchers and advantage to the public.

For it must be remembered that an inspector, to perform his duties properly, must have an extensive, varied, and profound knowledge of the different subjects connected with this matter, which only veterinary studies carefully conducted can prepare him for. The ordinary superficial, empirical notions which meat inspectors—such as policemen—generally possess, are of little value, and are as likely to lead them to erroneous as just conclusions. Only those who have properly studied the structure and composition of animals in health, and are thoroughly acquainted with their pathological anatomy, such as modern science has taught us, and can avail themselves of the assistance to be afforded by the microscope, chemistry, and other means of investigation, are competent to pronounce as to the soundness or unsoundness of flesh which is to be consumed as food. In fact, unless a man is a good comparative pathologist, he cannot be a good inspector.

MODE OF CARRYING OUT INSPECTION.

This inspection might be included in the number of duties pertaining to the veterinary sanitary service, or it might be entirely of a local kind. In each district, there might be one or more individuals employed by the municipality, whose duty should be to inspect the butchers' shops therein; these,

if not themselves veterinary surgeons, should be under the surveillance of the district veterinary surgeon, to whom they must report any occurrence worthy of investigation. They should inspect the animals before they are slaughtered, and the carcasses in process of being dressed, and particularly the organs of the chest and abdomen. If possible, no flesh should be issued for sale without the inspector's certificate; and when an epizoöty prevails among animals whose flesh is utilized as food, the veterinary surgeon should alone bear the responsibility of inspection, as he should also do in the case of animals killed because of disease.

These agents of the veterinary sanitary service might also act as inspectors of slaughter-houses, with regard to their salubrity and cleanliness, as well as knackers' establishments.*

VETERINARY INSPECTION OF MEAT.

The inspection of meat, as it should be carried out, has more particularly for its object the ascertaining (1) the quality of the meat, (2) its state of preservation, (3) its sanitary condition, and (4) to what species of animal it belongs. These different points we will consider in the order in which they stand.

1. *The Quality of the Meat.*

The quality of the meat depends, of course, upon the animal's age and condition, and the part of the body from which it has been obtained. So far as quality is concerned, three kinds of meat may be observed. The first comprises flesh of a bright red colour, well mixed with white fat, firm and elastic in consistency, and possessing an agreeable odour. The best is obtained from fattened adult oxen, aged from four to eight

* In Switzerland and Bavaria, in some parts of Germany and France (particularly at Bordeaux), and in Belgium (at Brussels especially), this veterinary organization exists, and is of great public utility. It is very probable that in a few years it will be established throughout the Continent. In this country, as has been mentioned above, this important duty is generally entrusted to policemen, market clerks, and other such incompetent people.

years, and which have been early castrated. It may be exceptionally obtained from fat cows, not more than six years of age, and especially when they have been "spayed."

With regard to veal, the calves should be at least three or four to six weeks old, and be fattened for slaughter.

Sheep ought to be from two to four years old, and properly fattened. Pigs, male and female, should be fat, and castrated in their youth.

Flesh of the second quality should still have a good red colour, but it has less fat, and is procured from animals which are of inferior fattening qualities, older than the preceding, and those which have been bred from, or have not been very well cared for.

The third quality of flesh is generally darker in colour, or it may be paler; it is soft, poor in fat, and watery; after drying for two or three hours, the connective tissue becomes yellowish instead of remaining of a pearly-white hue. It is obtained from animals too young or too old, and which have been only indifferently fed. With young animals, the flesh is pale; if the colour is too dark, it may be suspected to have been obtained from a bull or from an overdriven animal.

Properly, only the two first qualities should be allowed to be sold; though custom has tolerated the sale of the third.

It has been stated that calves and lambs should not be killed too young. In this condition their flesh is gelatinous and watery, and little nutritive; the fat is grayish-coloured, and scant. They may be known by their dentition, though this is not always a sure guide, neither is their weight. It is generally more advisable to take into consideration the general state of the animal; if it is lively, firm on its limbs, and if the umbilicus has become cicatrized (which usually occurs about the tenth day) and the horns begin to appear, then the animal is fit for slaughter.

In addition to these signs, when it is killed, the flesh should be found of a tolerably white colour (varying with the quantity and quality of the milk upon which it has been fed) and not red; it should be firm and juicy, but not infiltrated, and the fat should be of a good consistency, and plentiful in the

region of the kidneys. The articular surfaces, particularly of the knees, should not be too large; they should be of a light leaden hue in a well-grown calf; they are reddish in younger animals. The degree of consolidation of the epiphyses of the bones is also a certain index of age; as is the marrow of the long bones, which is a blood-coloured pulp in too young animals, but in those which are older it is firmer and more like fat.

Cattle and other animals should be inspected before they are killed—the period varying with circumstances—and after being dressed a certain time; as well as in the process of dressing, if there is any suspicion as to their state of health.

When the carcass is cut up into quarters, the external surface should be pretty generally covered with a layer of white fat; the inner surface of the carcass should also offer the same appearance, the fat being most abundant about the kidneys, and extending thence beneath the spine, and also covering the abdominal muscles. The fat should be firm and solid, without blood-stains, and white; though the colour is somewhat influenced by the previous feeding, some kinds of food imparting a yellow hue to it. The pleural and peritoneal membrane should be intact and smooth; when scraped or removed, it is suspicious; the pleura should be quite transparent, and the rosy colour of the intercostal muscles, nearly covered with fat, should be visible through it.

The colour of meat when cut across is somewhat variable, and depends upon breed and other circumstances. In the butcher's stall the meat should be firm, elastic to the touch, and should not yield any serum when newly cut. Though good meat, when placed on a white plate, is often observed to yield a very small quantity of reddish fluid after a certain time, its odour should be fresh and pleasant; the marrow of the long bones is solid (particularly in cold and temperate climates), and of a dull light-red hue; in the fore-limbs the marrow is softer. It should not be infiltrated, soft, brown-coloured, or stained with dark patches. The flesh on section should not present any lividity or staining; but the muscles ought to be of an uniform tint, or even lighter in colour in their interior, and there should

be no softening, infiltration, nor morbid products in the intermuscular connective tissue.

The arrangement of the fibres in bundles, thin layers, or masses, together with their length, constitute the value of the flesh in different regions of the body. These bundles are surrounded by connective tissue, in the meshes of which the fat is deposited; and the amount of this indicates the degree of fattening to which the animal has attained, and gives the section a marbled appearance. The quality of the beef is, perhaps, best ascertained in the "rib-cut," and "sirloin;" in these the proportions between the fat and lean, as well as the fineness of the grain, may be most readily perceived.

Meat should not be excessively fat, as there is then a loss of flesh; when soft and watery, it is likewise deficient in nutritive qualities.* The bone should be little more than twenty per cent. of the entire flesh.

Though we have enumerated three qualities of meat, yet there is what may be designated a fourth quality, derived

* In 100 parts of meat, Parkes gives the following proportion of constituents :—

	Water.	*Albuminates.*	*Fats.*	*Salts.*
Meat of best quality, with little fat ...	74·4	20·5	3·5	1·6
„ common quality	75	15	8·4	1·6
„ very fat	63	14	19	3·7

Moleschott gives the composition of fresh beef (according to Parkes, this is the mean of all the Continental analyses), as follows :—

Water	73·4
Soluble albumen and hæmatin	2·25
Insoluble albuminous substances	15·2
Gelatinous substances	3·3
Fat	2·87
Extractive matters	1·38
Kreatin	0·068
Ash	1·6

The proportion of water in these analyses appears to be very high. Letheby gives it as not exceeding 45 per cent. in very fat meat, and 65 per cent. in lean. More than one-third of the ash is phosphoric acid, and is alkaline. Salt beef has been estimated as certainly not equal to more than two-thirds the quantity of fresh beef.

from very lean animals, or those which have been sick; but this is not injurious as food.

There is a large quantity of this kind of food sold, and there is certainly no reason to interdict its use, so long as it is sold at its proper value, and is not passed off as good. It should be disposed of in special establishments, and these should be vigilantly watched by the inspectors.

The flesh of unborn calves, when they are nearly full time, is not unfrequently dressed and offered for sale. It has very little nutriment, and is most objectionable in many ways; its use should, therefore, be interdicted. It is recognized by its paleness, softness, and extreme wetness; as well as by the appearance of the bones, cartilages, and other characters already referred to. If the lungs are present, the condition of these will show that the creature has never breathed.

The flesh of animals which have died a natural death, or been suffocated or drowned, has generally been interdicted; but there is no evidence that it is in the least degree injurious. It, however, does not keep so well, alters quickly, and has not the value of flesh from animals which have been purposely killed for food.

Such flesh is very frequently sold in butchers' shops in poor localities, and it is necessary that it should be recognized. It is of a dark-red or purple colour, due to the blood retained in the veins, and which transudes from them, stains the adjacent tissues, and gives rise to cadaveric stains; to these are often added more or less extensive patches of ecchymoses, resulting from the struggles of the animal. The kidneys are gorged with blood and always livid; the peritoneum has a greenish hue, which is all the more marked if there has been delay in removing the abdominal viscera. The muscular fibres are often ruptured and detached from the bones, and the flesh retains the impression of the finger. The meat has a dull aspect, and a peculiar cadaveric odour; it does not become firm by exposure to currents of air, but remains flabby and damp in consequence of the large amount of serum with which it is infiltrated, and which frequently accumulates in the muscular interstices. If these external features are not sufficiently marked

to enable a conclusion to be arrived at, deep incisions should be made; or the shoulder should be removed, if it still remains attached to the carcass. The cadaveric aspect and odour are then more noticeable because of the large muscular surface suddenly exposed, as well as the large blood-vessels incised. In section, drops of blood exude from the small vessels in the cut surface, and fibrinous clots are often observed in the large veins; when handled it stains the fingers deeply. The colour is frequently very unequal throughout the body; it is often dark-red in certain muscles, particularly those of the side on which the animal was lying when it died, pale in others where the serum is colourless, and dull-looking; when exposed to the air it sometimes is changed to a brick-red tint.

It is to be observed, however, that the flesh of calves is not so dark-coloured as that of cattle, as their blood is not so rich in red globules; indeed, the flesh is often remarkably colourless, soft, and humid.

With regard to the fat—external as well as internal—it remains soft, damp, and unpleasant-looking, and soon acquires the greenish hue of putrefaction.

The flesh of over-driven, exhausted, or fatigued animals has, as is alluded to at page 107, often been blamed for producing ill effects when eaten. Such flesh has a dark colour, and a strong odour; this is most noticeable when the muscles are cut. Effusions of blood into the muscles are also not unfrequent, and they are often found in the articulations, particularly in that of the hip.

With fat animals fatigued by long marches and hardships, inflammation and fatty degeneration of the muscles has been observed. The appearances in some cases so closely resemble those of Anthrax (which see), that it is difficult to distinguish them from those presented in that disease.

The flesh keeps badly, and very soon putrefies, especially in damp, hot weather. When the alterations are not very considerable, there may be no danger in utilizing such flesh as food; but the greatest care should be exercised in this respect.

2. *The State of Preservation of Meat.*

From its chemical composition, flesh cannot be kept for any length of time in temperate or hot climates (particularly if humid) without becoming altered, putrid decomposition taking place. This decomposition is what is termed "ammoniacal;" dry decomposition only taking place in a very dry atmosphere, which rapidly abstracts the water.

The flesh has a very unpleasant, but characteristic, smell; it becomes of a greenish hue; it is soft and clammy, and preserves the imprint of the fingers; and a brownish viscid serum often covers its surface. The alteration is particularly noticeable near the bones, where it takes place most rapidly; and certain conditions of the atmosphere and temperature greatly favour it. It may occur within a few hours after the death of the animal, and is frequent in summer, but rare in winter. Cold delays it considerably, and ice is an excellent preservative; a thaw is much in its favour.

When decomposition is advanced, such flesh is readily recognized, and it is rarely offered for sale.

The course of decomposition is easily followed. Soon after the carcass has been cut up, a certain amount of evaporation, depending upon the dryness of the air and its movement, takes place from the surface. Soon after the *rigor mortis* has passed off, certain somewhat obscure changes commence in the substance of the flesh, which result, after a day or two, in making it more tender and pleasant to eat. When cooked before this change has occurred, it is hard and tough; but after it has gone beyond this stage, the flesh loses its cohesiveness, and its juices becoming coagulated, are deposited on the cut surfaces; there they become corrupt, and exhale that peculiar odour of flesh which has been too long kept. This change is at first confined to the surface, but it extends with more or less rapidity, according to many circumstances; and the meat becomes soft, clammy, wet, and gluey. At a further stage putrefaction is still more evident to the senses; and it is at this period that *les gourmets* prefer several kinds of game, from the special putrefactive

aroma developed. This is not the case with butchers' meat, however, which, as soon as putrefaction has advanced to a certain degree, inspires an insurmountable repugnance, no less from its unpleasant, greenish aspect and disagreeable touch, than from its nauseous smell. Even were it otherwise, such flesh could not be recommended for consumption. When boiled, it yields a muddy broth possessing a bad taste, and which rapidly decomposes; while the flesh, either roasted or boiled, has a detestable smell, and cooking does not arrest the process of decomposition. Such food has very often given rise to serious symptoms in those who have partaken of it. Putrid fevers; gastric and intestinal derangement; symptoms similar to those produced by poisoning with metallic salts, or those of Typhus; and vomiting and prostration, have all been observed after the ingestion of such food, and forbid its issue to the public.

The inspector may also find putrefied flesh in those food preparations which are so frequently sold nowadays, such as sausages: for the manufacture of which unsound meat is often largely used.

In decomposed flesh, especially if it is salted and chopped up, as in sausages, toxical compounds may be generated which cooking, smoking, or spicing will not always prevent. The manufactories of these articles should be visited, and the materials employed carefully inspected. Copper or lead vessels should not be employed in their preparation, nor should the food be enclosed in canisters made of these. Flesh which is being pickled should be thoroughly examined, as well as that which is smoked or prepared.

In order to mask or destroy the offensive odour of putrid meat, and especially pork, it is sprinkled with pyroligneous or carbolic acid, creosote, &c., or well smoked; but it is always readily recognized by its softness, grayish-red colour, and bad smell when cut into, or when the blade of a knife has been thrust into it. If pork has still the skin attached, this may be covered with mould, and a damp, viscid, foul-smelling exudation of a grayish colour. If some of this is examined by means of the microscope, after being wetted with a little water, there will be observed a number of pseudo-vibrionæ moving about

in the midst of a mass in which the *débris* of mucedines may be detected. These bodies can also be detected in rotten sausages in greater abundance; often in breaking an unsound sausage, cavities will be discovered filled with mould and vibrionæ, while the flesh around them has an unpleasant, grayish-brown or greenish colour, and a repulsive, rancid, sour smell, due to the development of two fatty acids which are more or less in combination with ammonia. The entire contents of the sausage are softened and unsightly. The same alteration occurs in hams. Flesh in salt pickle or brine also undergoes alteration, or may be bad before it is pickled. Bubbles of gas form on the surface of the brine, and produce a white scum; and the meat itself is soft, has a bad smell, and is sticky and green.

The sale of such food should be rigidly interdicted. Nothing is known, as has been already said, as to the nature of the poisonous substance formed in such manufactured foods as sausages, pies, hams, &c., which, through having been made of putrid meat, kept too long after being prepared, and particularly after having been exposed to heat and damp, generate a toxic agent that gives rise, in those who eat the food, to severe gastro-intestinal disturbance, nervous derangement, and death. By some it has been conjectured to be phenylamine, trimethylamine, or amylamine; but Schlossberger has shown that these are not poisonous. Others have thought it might be of a fatty nature; while others, again, assert that it is a fungus—the *Sarcina botulina* (Vanden Corput)—like a Sarcina.

Payen is certainly of opinion that the pernicious ingredient—the *Wurtsgift*, as the Germans designate it—is due to microscopical fungi which are developed on or in the flesh, the juices of which readily acquire the acid character suitable to their growth.*

Unless the meat or sausages have an unpleasant smell, their

* The poisonous effects of this agent, whatever it may be, have been most frequently observed in Germany, where a large trade is carried on in smoked flesh. Kerner collected the histories of 135 cases of "Wurtsgift" poisoning, which occurred in Wurtemberg between 1793 and 1822; of these eighty-four died.

condition may not give rise to suspicion. It has been recommended to mix them with a good quantity of water, boil them, and then add newly-made lime-water. If the sausages are good, they give off only a very slight, and not unpleasant odour of ammonia; whereas, if bad, the smell is much stronger and disagreeable.

Old brine of meat frequently possesses toxical properties.

Putrefying lard becomes yellow, and has a rancid odour and bad taste; while tallow becomes yellow, then green.

Flesh is sometimes altered in such a manner that it suddenly becomes phosphorescent—an appearance readily observed when it is placed in a dark room; otherwise it may look quite fresh, and have neither a special odour or taste. It is possible that this luminosity may be due to the production of what has been termed "noctilucine"—a nitrogenized fatty matter possessing a great affinity for oxygen, and phosphorescent in the dark, and which is formed in dead fish. It has also been recognized in phosphorescent animals.

Flesh may also become impregnated with the larvæ of various insects, some of which may be swallowed with it, become developed in the body of the person who ingests it, and thus give rise to diseases which have been classed under the head of "myasis." Among such insects are the large gray flesh-fly (*Sarcophaga carnaria* or *Musca carnaria*), which moves with great rapidity, making a continual booming or buzzing noise as it flies.* It is oviparous, and remarkable for its fecundity, as, according to Oken, it can deposit an average of 20,000 eggs on a very small surface. Their ova are deposited on flesh; they are like white worms, soft, without feet, thick posteriorly and gradually tapering towards the head, the mouth being furnished with a sucker and two hard hooks well adapted for tearing and dividing.

The "blue bottle" or flesh-fly (*Musca vomitaria*) is equally

* It is characterized by its large size; the eyes wide apart; the body of a golden-yellow colour anteriorly, and covered with long bristly black hair; the chest is gray, with four black longitudinal lines, and the abdomen is a shining black surface, with four square, white spots on each ring.

prolific, and a great annoyance to butchers.* It has a keen scent, and quickly discovers flesh, especially if this is fresh. It has the unpleasant faculty of vomiting a fluid on the meat, which accelerates decomposition, and then it lays its eggs. The worm-shaped larvæ or maggots hatched therefrom become rapidly developed, and soon crawl over the whole surface of the meat.

There are also the common house-fly (*Musca domestica*), the golden fly (*Musca Cæsar*), and others which likewise deposit their eggs on flesh, though, unlike the blue fly, they do not prefer it fresh; on the contrary, the golden fly appears to select carrion, which its larvæ eagerly devour.

In lard are sometimes found the larvæ of a fly—the *Aglossa pinguinalis*.

Flesh much soiled by the larvæ of flies should not be allowed to be sold, as it may prove injurious; and it is the fault of the butcher if it is so soiled, as simple precautions would protect it—such as putting gauze over the meat, or sponging its surface with a small quantity of sulphuric acid.

We have now mentioned some of the causes which influence the preservation of meat; but there are others which must be noticed, the principal of which is the way the animal has been slaughtered. The better the animal is bled, the longer will its flesh keep; as the blood is extremely prone to speedy decomposition. The flesh of animals which have been insufficiently bled is known by its dark colour, moistness, blood escaping on section of the muscles, the large blood-vessels containing blood, and the liver also more or less gorged with that fluid.

There can be no doubt whatever, that the more care taken with animals immediately before they are slaughtered, the better will their flesh keep; as it is well known that the flesh of those which have been fatigued, excited, or beaten and abused, is difficult to preserve. So well is this understood, that at some ports from which the carcasses of animals are sent, the

* This fly is only too well known. It is smaller than the preceding, and has a brownish-yellow tint; the eyes are near each other; the thorax is black, and the abdomen blue, and striped with black. It makes a loud buzzing.

cattle are killed during the night, as they are then more tranquil, and the flesh stands the voyage better. Calmness and rest are necessary for the production of good-keeping meat. Slaughtering immediately after feeding does not improve the keeping qualities of meat, nor yet does skinning too long a time after death; neither does the filthy and pernicious practice prevailing in some slaughter-houses, of blowing into the subcutaneous connective tissue to assist in removing the skin, tend to improve the flesh in this respect. If insufflation is necessary, bellows should be resorted to.

The different animals whose flesh is consumed as food, do not offer an equal readiness in passing into a state of decomposition after death. Lamb putrefies most quickly; then veal, especially if from a lean calf; then come pork, mutton, ox-flesh, and horse-flesh. Meat of good quality will keep longer than that which is inferior; and that which is from young animals, soft and juicy, has much less resistance than that of adult animals, which is firmer and drier.

There is also a difference in the various fluids and textures of the same animal. The blood decomposes with the greatest readiness; then those tissues which are soft and loose in texture, such as the fat and lymphatic glands; those containing much blood or other fluids, such as the liver and kidneys; and the superficial muscular fibres sooner than those which are deep seated. The region of the neck, because of the blood which soils it, and the wetness from its being washed to cleanse it; and the region of the shoulders, because of the great quantity of connective tissue there, are also the first to be involved in decomposition.

Meat can be preserved for some time by exposing it, soon after the carcass is dressed, to the fumes of sulphur; quarters or other portions may be treated in this way. Such a simple preservative also keeps off the flies, and prevents the formation of fungi. Washing with water immediately before cooking, removes the acid and its odour.

3. *The Sanitary Condition of Meat.*

The inspection of flesh after the carcass has been cut up, is

not very satisfactory,—hence the necessity for examining it while the carcass is intact or in process of dressing, and also examining the animal before it is killed. The organs in the chest and abdomen should be seen; for when these are removed and the body quartered in the usual way, it is often most difficult to distinguish the flesh of a diseased from that of a healthy animal in some cases; though generally there are physical differences—sometimes very slight, it is true. The difficulty is, of course, greatly increased by the butchers, who resort to every artifice to conceal diseased meat, and sell it as sound. This is more particularly the case in towns where private slaughter-houses are tolerated, and where the source from which such animals are derived is not easily traceable. There is an immense traffic in the flesh of diseased animals, and especially in that of those which have been suffering from contagious diseases of a formidable kind.

We have already detailed the essential characteristics of healthy meat, and these should be remembered when we come to compare it with that which is diseased, and especially when it is cut up into quarters. We have said that healthy meat is firm, elastic, covered with fat of a good consistency, and more or less marbled from its presence when cut across. It cuts well; has a uniform bright-red colour, and the interstitial connective tissue is rather dry than moist. When newly cut, there exudes from it, especially on slight pressure, a highly-coloured slightly-acid juice, possessing an agreeable odour, which is most marked, perhaps, in cooking. Such meat increases in bulk by boiling in water, and even in roasting. Diseased meat, on the contrary, though it may possess some of these properties in certain cases, yet is deficient in others. If the inner aspect of the ribs has not been tampered with, we may discover the presence of tubercles or Pleuro-pneumonia, and if the lining membrane has been scraped or removed, then suspicion may be aroused. If the peritoneum is intact, we may find trace of Tuberculosis, Anthrax-fever, Peritonitis, &c. The condition of the kidneys, lymphatic glands, spinal marrow, veins, and other organs, if they are accessible, may betray the marks of diseases of various kinds. When the muscles

are under examination, in case of doubt a large surface should be exposed with the knife.

In the preceding section of this work, we have considered the question of utilizing, as food, the flesh of animals which have been suffering from contagious diseases; so that it is unnecessary to occupy ourselves with their consideration again. What refers to Cattle-plague will be found at p. 403; Contagious Pleuro-pneumonia at p. 443; "Foot-and-mouth" disease at p. 476; Glanders and Farcy at p. 560, vol. i.; Variola at pp. 71, 98; Anthrax and anthracoid diseases at pp. 188, 195; Fowl-cholera at p. 219; Rabies at p. 288; Tuberculosis at p. 393; Trichiniasis at p. 513; Measles of the Pig at p. 533; and Measles of the Ox at p. 549, vol. ii. As these are the most important maladies, so far as the healthiness of flesh is concerned, we have now only to glance at some others of less consequence.

Inflammation.

The flesh of animals which have suffered from inflammation of an organ, even though it should be essential to life, cannot always be considered as unhealthy; and its consumption may, therefore, be authorized, provided the creatures have been bled to death, and the inflammation is in an early stage. It is different, however, when the inflammation has continued for some time, and its acute stage has been accompanied by very intense fever: resulting in material alterations of the body, through the circulation. In such a case, at the very least, the flesh cannot be so nutritious, and must be of inferior quality.

Under the influence of the suffering caused by inflammation, the carcass is more or less deeply injected throughout, the colour being redder than in health, and unequal: being sometimes a brownish-red, at others a deep-brown. The flesh has also lost its firmness, partly, no doubt, owing to transudation of the serum of the blood; the latter fluid is often effused into the tissues, rendering them more friable, and even destroying their texture. As the results of inflammation, we may also find, on examining certain parts, fibrinous exudations and false membranes, effusions of serum or blood, enlarged lymphatic

glands, collections of pus, extensive ulcerations, sanious infiltrations, gangrene, &c.,—all of which lead to certain inferences, and are to be seriously considered in discussing the propriety of allowing the flesh to be used as food. In all cases, it is absolutely necessary that the inspector should see as much of the carcass as possible; and this affords a strong argument in favour of carcasses from elsewhere than the immediate locality, being kept as intact as possible. The "dead meat" traffic will always require careful inspection.

Cancerous Diseases.

Cancerous diseases are somewhat analogous to Tuberculosis; and as they are generally accompanied by a constitutional taint, animals so affected, even when the malady appears to be localized, should not be disposed of for food to mankind.

Purulent Infection.

Purulent infection (or "pyæmia") enters into the same category; and as it is usually accompanied by metatastic abscesses in the most diverse parts of the body, the inspector cannot be too careful in his examination. Nothing is so repulsive as these purulent deposits in flesh exposed for sale as food; for abscesses of various sizes may extensively occupy the muscular system. Whenever any part of the body is the seat of inflammation and suppuration, the inspector should be suspicious of Pyæmia.

Putrid Decomposition.

Putrid decomposition of some tissues of the body, or gangrene of an organ, will sometimes give rise to that general blood-poisoning, technically designated "septicæmia." In this condition, the blood has nearly or quite lost its power of coagulating, is of a dark, dirty-looking colour, staining the tissues by imbibition; the flesh is dark-coloured, moist, and sanious; the fat, soft and yellowish-red, is surrounded by infiltrated connective tissue. In the pig, this condition of the flesh is not at all unfrequent, inflammatory diseases of apparently the most trivial kind often running into gangrene in a very short time. The blood and the flesh frequently have a

sour smell and an acid reaction; at other times the odour is ammoniacal. Such flesh should not be used as food.

Suppression of Urine.

In suppression of urine (or "uræmia"), the tissues are more or less infiltrated with a fluid smelling strongly of urine; the blood has also a violet colour, and does not coagulate. The flesh is not suitable for food.

Jaundice.

When the flesh is deeply stained with the colouring matter of the bile, resulting from what is termed "*jaundice*," and which may arise from some obstacle to the flow of that fluid, it should not be used as food. Usually, animals in this condition are affected with Dropsy, and then their flesh is flabby and innutritious. The fat betrays the state of the animal more than the muscles; it is soft and yellow, and has a very repulsive appearance.

Dropsy.

General or local Ascites, or Dropsy, demands some notice. The inspector must take into consideration the condition of the body as a whole. In the majority of cases, such carcasses will be condemned as improper food, or, at least, as of little value. In cases of local disease, removal of the affected parts may permit the others to be utilized.

Rot.

"Rot" in sheep, and also sometimes in cattle, belongs to this class of dropsical maladies. It is characterized by the presence of "flukes" (the *Distoma hepaticum* and *lanceolatum*) in the biliary ducts, and sometimes in the liver, and to such an extent that this organ is alive with them. Bidlow has observed 800 in a single liver, and Dupuy has counted 1000; the usual number appears to be from 100 to 300. These parasites may be transferred to the human species, and produce the Echinococcus disease (a rare malady in every country except Iceland, it would appear). The disturbance they cause in the

sheep renders the flesh of these of poor quality, being soft, pale, and watery; it decomposes rapidly. When the disease has reached a certain degree, and more especially when there is much Dropsy and the flesh smells of urine, its sale should be prohibited.

Gid.

"Gid," "sturdy," or "turnsick," is also a hydatid disease of the sheep and ox, and is due to the presence in the envelopes of the brain of the *Cœnurus cerebralis*. It is of no importance to man, except in so far as it renders the animal emaciated, and is often accompanied by disease of the intestines; the flesh is consequently of inferior quality.

Ovine Bronchitis.

The Bronchitis, or "phthisis" of sheep, and sometimes of cattle, due to a parasite—the *Strongylus filaria*, or *Echinococcus veterinorum*—has no other effect than, in an extreme degree, to induce marasmus, which renders the flesh of a very inferior quality, and of but little value as food. Other parasites not mentioned have no other effect.

Diarrhœa and Dysentery.

Diarrhœa and Dysentery only render the flesh poor and innutritious as an article of diet.

Wasting Diseases.

In all wasting diseases, except those specially enumerated, it generally becomes a mere question of the nutritiousness of the food, provided the animals have been killed. In many cases it will be found the most advisable course to forbid the use of the flesh as food for mankind, as it cannot furnish anything but the most scanty nutriment; and the fact that the animals were in a sickly state, militates strongly against their flesh being proper for consumption.

Local Maladies.

What may be called "local maladies" demands attention. A

large number of these consist of affections and accidents consecutive to parturition ; and it may be remarked with regard to them, that, provided the animals have been killed in time, their flesh may be allowed to be used as food. Not unfrequently there are extensive infiltrations in the hind quarters ; the parts in which these have occurred have an unpleasant aspect, and may be removed, in order that the other portions may be used. In Metro-peritonitis, the flesh has generally a repulsive appearance, and often precludes its issue as food ; it should always be prohibited when gangrene has commenced, or when there is any suspicion of Pyæmia or Septicæmia.

Putrefaction of the fœtus should cause the flesh of the cow to be rejected; and more especially as the odour of the decomposing fœtus is communicated to it. When cattle have been killed in consequence of Paralysis after parturition, the flesh may be used, provided the animals have not had medicine, and they have not bruised themselves much in struggling ; in the latter case, there is generally gangrene and infiltration of the salient parts of the body, with an alteration in the flesh which should cause it to be rejected.

With regard to diseases and accidents of the digestive organs : if the animals are killed at an early period, before receiving drugs, and the stomach and intestines are promptly removed, there is no reason why their flesh should not be sold as food.

Diseases of the chest—such as Bronchitis, Pneumonia, &c., may be placed in the same category ; the flesh may be used, but not the viscera, provided there is not excessive emaciation nor alteration in the muscles.

In the case of accidents—such as fractures, dislocations, serious wounds, &c.—the flesh may usually be utilized, except the parts adjoining the seat of injury. When gangrene has set in, however, it should be prohibited.

With regard to poisoning, when the toxic agent has entered the blood and produced more or less marked symptoms, the flesh should not be used. When the action of the poison has been purely local, however, it may be utilized : provided the intestines or parts acted upon are removed. The flesh of an

animal suspected to be suffering from poison, the nature of which is not known, should be prohibited. Many of the metallic poisons taint all the tissues; and the vegetable alkaloids have a similar diffusive power, as well as the resins of many poisonous plants.

The same remarks apply to the flesh of animals to which medicines have been administered before they were killed. These enter the circulation, and are carried by the blood to the tissues, which they may soon impregnate. If there is reason to believe that sufficient time has not elapsed for these medicaments to be expelled from the animal's system, and that they are dangerous, the flesh should not be issued for food; as those who consume it might be exposed to the risk of serious consequences. Impregnation with medicaments having a powerful odour is not at all uncommon. Such volatile substances as assafœtida, creosote, oil of turpentine, camphor, ammonia, sulphuric æther, &c., rapidly impregnate the flesh, and the odour does not pass off for a long time. Certainly, they do not render it absolutely unfit for food, but they communicate an offensive smell and taste to it which few can bear. The presence of such substances can be readily perceived on opening the carcass; but when this has been cut up into quarters, it is different. The flesh may then have no trace of them, even on incisions being made into it; but if a small portion is steeped in warm water for a short time, or cooked, the characteristic disagreeable odour is at once evolved.

Such flesh should not be used as food.

DESTRUCTION OF CONDEMNED FLESH.

Flesh condemned as unfit for human food, should be either buried, handed over to the knacker, or allowed to be sold as food for packs of hounds, if it is deemed suitable. In certain cases, the tallow, skin, hoofs, horns, &c., may be utilized. This permission should not be accorded too freely, unless it can be ensured that care will be taken not to allow the food to find its way to the butcher's stall. When this cannot be done, the flesh should be impregnated with some substance

which will prevent its being offered for sale, even after it has been buried in the ground. This is best done by making large and deep incisions into the flesh, and pouring therein coal tar, oil of turpentine, creosote, or carbolic acid, or a mixture of these. Defays invented an instrument for this purpose: this consists simply of a tube with a lancet-point, and near its end a number of holes, with, at the other end, a flask containing the mixture which is to infect the flesh. At each puncture, a certain quantity of the fluid is allowed to flow. Köpp recommends a spatula with sharp edges, and grooves on its surface like those of an inoculation needle. This spatula is dipped into the infecting fluid, and then thrust into the meat.

Or the meat may be powdered with quick-lime, chloride of lime, smeared over with coal tar, or with a mixture of sulphuric acid, sulphate of iron, and soot.

4. *The Species of Animal to which Flesh belongs.*

It is not always an easy matter to pronounce with certainty as to the species and sex of an animal, from the inspection of a portion of its flesh, and particularly if this be salted or smoked, or manufactured into sausages. In this matter a knowledge of comparative anatomy is all-important. If the carcass is whole, or is in quarters, the distinction is easy, and the sex may be even distinguished. In the same conditions of age and quality, the bullock may be distinguished from the cow by a wider and less curved side; and a deeper groove on the posterior border of each rib, more particularly observed on the inner surface. The pelvis of the bullock is narrower and shorter, and the pubic bones thicker, harder, and firmer united. The muscles of the bullock are also not so much developed, the neck is finer, and the legs thinner and longer. The external fat forms a good covering at the upper and lateral parts of the trunk; the suet is abundant around the kidneys, in the pelvis, and even in the interior of the chest; the flesh has a fine red colour, and its odour is agreeable; it is juicy, fine in the fibre, and the marbling, in a transverse section, is well marked. In the carcass or quarter of the cow, there can

always be found traces of the suspensory ligaments of the udder, and the excavation the butcher makes in removing that organ ; in the bullock and in the bull traces of the penis exist. The bones of the cow are finer than those of the bullock; the neck is also lighter; the pelvis is much wider, and at the entrance there are always found a portion of the suspensory ligaments of the uterus ; the flesh is not so bright as that of the bullock, neither is it usually so juicy, though it may be finer and softer in the fibre. The fat is similar to that of the bullock ; it has a yellowish tinge in old cows. The carcass of the bull is distinguished from the ox and cow by the roundness of the muscular parts of the fore and hind-quarters ; the root of the neck is voluminous, not so long, and rounder than in these animals, and the pelvis is narrower and shorter The sexual parts have less fat about them, and altogether the fat is deficient ; the traces of the penis are more marked than in the bullock, and the spermatic cord and artery are fully developed, while in the latter they are atrophied. The flesh of the bull is drier, redder, harder, and has a coarser fibre ; it is less marbled, and when the muscles, especially those of the thigh, are incised, they have a peculiar odour, said to resemble that of the spermatic fluid. At the posterior angle of the ischium is remarked the strong muscular attachment, or fibrous disc, of the accelerator muscle, which is always much more voluminous in the bull than the ox.

The flesh of the horse is always of a reddish-brown colour, becoming darker on exposure to the air, and looking as if burnt in old animals. It is not usually much esteemed as food, partly because of prejudice against it, and also because it is less fat, harder, and tougher than good ox-flesh. It has, besides, an odour—that of the stable—which the majority of people do not like. Nevertheless, it possesses good nutritive qualities, and is very healthy food ; and it is to be regretted, on the score of humanity, as well as in the interest of the poorer classes of people, that it is not as yet a common article of diet. In addition to its colour and odour, the muscular tissues are generally finer in the fibre, and not so close as those of the bull. The connective tissue is very fine, and not

abundant, and does not exhibit the opalescent tint, due to its condensation, witnessed in the muscles of the bovine species. The fat is little abundant, and very soft, even at a low temperature ; it is not deposited between the muscular fibres, and therefore does not give the flesh that marbled aspect so noticeable in ox-beef. Owing to its soft consistency, it transudes through the tissues, and gives them an oily appearance. The flesh is also much divided by numerous tendinous intersections, and is firmer and less elastic to the touch than that of the ox.

With regard to small portions of meat, the species of animal to which it belonged may generally be ascertained from the consistency of the fat, and the manner in which it is disposed in the muscles. In the bovine species, it is white and hard, and penetrates the flesh so as to appear well mixed with it ; in the horse, it is absent from the interior of the muscular masses, and is yellow and soft ; in the pig, it is also soft, but it is white, well mixed with the muscles, and is more or less thick on the surface ; in the sheep, it is white and hard.

The "grain"—the closeness and fineness—of the flesh is not so characteristic, as it varies with breed, sex, condition, &c.

The general anatomical characteristics of portions of meat, often furnish strong proofs of their origin ; sometimes it is a bone, sometimes it is the termination of a muscle, and sometimes the arrangement of the ligaments, which enables us to distinguish the species, and even the sex and age ; at other times we are aided in this determination by observing the arrangement of the lymphatic glands, blood-vessels, &c. Sometimes it is necessary to make a comparative examination of meat, in order to arrive at a proper conclusion, and to submit it to various tests. For instance, portions of mutton and pork will offer very different appearances when fried. And when we cannot distinguish the characteristic odour of the meat, and so lose this guide to our research, we can still have recourse to a means of developing it. This is done by mincing a small portion, putting it in a test-tube, and pouring a little sulphuric acid over it. On being stirred with a glass rod, the

flesh evolves the odour peculiar to the animal from which it was obtained: thus horse-flesh gives out the smell which we perceive in stables and the clothes of grooms; ox-flesh, that of the cow-house and the clothes of cow-men; while sheep, pig, and dog-flesh, yield their own particular odour. This procedure, however, in many cases requires a good sense of smell in the expert.

Perhaps the test would be more successful if the flesh were first reduced to pulp in a mortar, and then the sulphuric acid added.

INSPECTION OF MILK.

IMPORTANCE OF MILK INSPECTION.

THE inspection of milk should be no less the function of the sanitary veterinary surgeon than that of the flesh. Its healthy condition is a matter of great importance, as it enters more or less largely into the diet of every person, and is almost the sole food of infants: containing, as it does, all the constituents necessary for maintaining health and promoting growth.

CHARACTERS OF HEALTHY MILK.

Healthy cow's milk should, according to Parkes, be quite opaque, of full white colour, without deposit or peculiar smell or taste; and, when boiled, it should not alter in appearance. Its chemical reaction should be slightly alkaline or acid, or even neutral; its specific gravity varies from 1026 to 1035, the average at a temperature of 60° (Fahr.) being 1030, a very large quantity of cream lowering it: the range being nearly 4° above and below the mean.

When examined with the microscope, the only elements found are round fat-globules of various sizes, and perhaps a small number of epithelial cells. Its chemical composition, when its specific gravity is 1030 and 1026 is, in 100 parts, as follows:—

	1030	1026
Casein	4 ..	3
Fat	3·7 ..	2·5
Lactin	5 ..	3·9
Salts	·6 ..	·5
Total solids	13·3 ..	9·9
Water	86·7 ..	90·1

Healthy milk varies in quantity and composition according to the age of the animal; the number of pregnancies, the amount being less with the first calf; the period after calving, as for a short time it is largely mixed with colostrum; the kind of food the animal receives, beet and carrot increasing the sugar; and the breed of the cow: some animals giving more fat (as Alderneys), and others more casein (as the long-horns). The last portion drawn in milking is richer in cream than that first obtained, especially if the animal has not been milked for some time.

NORMAL ALTERATIONS IN MILK.

The cream rises in from four to eight hours, and though it is hastened by adding warm water, its quantity is not increased. After standing for some time it alters, absorbing oxygen and giving off carbonic acid. According to Hoppe-Seyler, when placed in contact with three or four times its volume of air, it absorbs all the oxygen in three or four days; fat increases in amount, and oxalic acid is also said to be found. Lactic acid is developed at a later period from the lactin, the milk becomes turbid, casein is formed, and the cream disappears. The spontaneous coagulation of milk is determined, according to Béchamp, by the presence of microzymes, which are naturally present in it. The same authority asserts that freshly drawn milk contains a minute quantity of acetic acid and alcohol, which increases during coagulation, and with it the lactic acid is formed.

QUANTITIVE ANOMALIES IN THE CONSTITUENTS OF MILK.

The milk may be *watery*, in consequence of the animal eating aqueous, poor, or bad food, or drinking too much fluid

of a relaxing kind; digestion is generally impaired in such cases. The milk is diminished in density, and the amount of cream and casein is lessened.

The milk becomes too *rich*, or *fat*, and the casein is increased, when animals receive good food in abundance, and also when they are entering in œstrum. In this state, as well as when specially excited, the milk of cows contains leucocytes. This milk may act injuriously on young creatures, by causing Diarrhœa, Dysentery, and other analogous disturbances.

The milk may contain too large a proportion of *salts*, and these may sometimes be deposited as gritty particles at the bottom of the vessel. Such milk is said to be secreted by cattle affected with chronic diseases, and particularly pulmonary Phthisis and Tuberculosis.

QUALITATIVE ANOMALIES IN THE CONSTITUENTS OF MILK.

The alterations in the quality of milk may be divided, according to Haubner, into two classes: those which may be perceived at the moment the milk is drawn, or soon after; and those which are only developed under the influence of external conditions, in milk otherwise of good quality. But little is known with regard to the chemical phenomena which occasion these anomalies. The nature of the food, and a congested state of the udder, have been assigned as causes. Sometimes it is only the milk drawn from a single teat which is affected. Among these anomalies are the following:—

1. *Acid Milk which coagulates too quickly.*—The coagulation occurs immediately after the milk has been drawn, at a later period, or under the influence of a slight elevation of temperature; sometimes flocculent or lumpy clots are even formed in the teat. This alteration is usually due to inflammation of the whole or a portion of the udder: being sometimes confined to one teat; and it may also depend upon digestive disturbance, fever, or to a rapid acid fermentation of the milk in the udder in hot or stormy weather, when the animal is considerably heated by exercise; or through the admission of air into the milk-sinuses from the use of the teat-syphon.

The milk may also be too hastily transformed, through being kept in hot apartments full of vapours, or in unclean vessels, and especially those made of wood.

2. The *Yellow Milk* observed when there is irritation or passive congestion of the udder, is characterized by a tint often as deep as that of the yolk of an egg. This alteration is most frequently met with in the milk from newly-calved cows, and is due, in this instance, to the colostrum, which is composed of masses of fat-globules mixed with granular particles. Such milk coagulates very quickly, sometimes even in the udder, and yields butter with difficulty.

Steinmüller informs us that milk assumes the colour of saffron, when cattle have eaten forage with which orchids have been mixed.

3. *Viscid Milk* generally appears quite healthy when drawn from the teat; it is rare to find it viscid and stringy just then. It coagulates in the usual way, though generally imperfectly, and the cream is in small quantity and unequally formed on the surface. In attempting to pour it from the vessel, the cream flows in streaks, and the other portion more particularly runs off in viscid, mucus-like streams, like a strong decoction of linseed or half-melted glue. This milk has a stale, mucus taste; it is not acid, and gives but little butter, which has a bad flavour and does not keep.

This kind of milk is generally obtained from cattle which are, to all appearance, quite healthy, and its peculiarity may be due to the condition of the dairy, which is probably damp, badly ventilated, and contains unhealthy vapours; want of cleanliness in preserving the milk may also cause it to undergo this alteration. Certain atmospherical conditions may likewise influence its production. It appears to consist in a mucoid fermentation of the milk, and the consecutive transformation of the lactin and casein. The ferment produced, whatever it may be, will give rise to the same alteration when a small portion of this milk is added to a large quantity of that which is healthy.

In other cases this alteration appears to be owing to digestive derangement,—as it has been noted in the milk of poorly

fed and badly cared-for cows. This milk has been found to contain a large proportion of albumen, as well as carbonate of ammonia; hence the affection in cattle has been designated "lacteal albuminuria."

Vernier has witnessed it in cows in perfect health, fed on white clover and lupuline in flower, and kept at the picket in dry weather. Change of fodder and lowering treatment had no effect; but amendment and ultimate recovery took place on administering nitrated drinks. The milk was viscid and stringy, had a yellowish tinge, and in its mass were seen darker yellow points. In 100,000 parts were found no less than 11·02 of albumen, instead of 4·00, the normal proportion.

Microscopically, this milk resembles colostrum, but its power of converting healthy milk distinguishes it. It yields a scanty oily butter, possessing a bad taste; the milk itself, although disagreeable and repugnant as food, has not been proved to be injurious.

4. *Milk which does not yield butter.*—This milk is perfectly normal in appearance when obtained from the cow, coagulates in the usual manner, but scarcely yields any cream; the butter is separated from it with difficulty, or there may be none at all. The cream looks like an emulsion, becomes foamy in the churn, and is perhaps only converted into little masses of butter which cannot be made to cohere.

This defect is sometimes due to an alteration in the secretion, in consequence of disease of the udder or disturbance in nutrition. In other cases, it is observed in animals in perfect health and properly fed. Being only witnessed in summer, a high temperature may have something to do with its appearance. As the addition of a little acid to such a cream promotes the separation of the butter, and as alkaline cream does not yield butter, it would seem that this defect is due to insufficient acidity, in consequence of the imperfect transformation of the lactin into lactic acid, or the neutralization of the latter. It is usually sufficient, if the weather is hot, to place the churn in cold water, or to add a little acid to the milk, or a quantity of sour cream.

5. *Blue Milk* (*when drawn*).—Milk thus altered usually

appears, when being drawn from the cow, of a blue colour very different from the white aspect of normal milk. It is ordinarily rather aqueous, and throws up a very small quantity of cream, through which the blue tint can be readily perceived.

The cause of this blue colour does not yet appear to be satisfactorily ascertained; but it certainly is not due to the larger proportion of water the milk contains. It has been attributed to the ingestion of watery food, deficient in nutriment and altered in quality, as well as to gastric derangement; but it is more probably due, as Mosler remarks, to the cattle eating certain plants—as *Fagopyrum*, *Mercurialis perennis*, *Myosotis palustris*, *Polygonum aviculare*, and other plants. It does not appear to be injurious to health.

6. *Red Milk* (*when drawn*).—Parmentier and Deyeux, Fabre, Vallot, and Donné, have, according to Lafosse, observed this rose-coloured or red milk, which did not appear to owe its tint to any perceptible particles. Parmentier and Deyeux succeeded in producing it by feeding cattle on madder, and it is probable that the colouring matter in some plants may give this colour to the milk, which does not appear to be otherwise altered in quality.

7. *Bitter or "Rotten" Milk.*—This is characterized by a bitter, mawkish taste, a rotten, disagreeable odour, and the difficulty with which butter is made from it. It is most frequently obtained from dairies where cows are badly kept, fed on improper or altered forage, and drink dirty, putrid water, or water containing decomposing organic matter.*

ANOMALIES IN COAGULATION.

The alterations in this group are characterized by the fact that milk, perfectly normal at the time when it is drawn, acquires abnormal qualities during coagulation.

They are, according to Haubner, due to the existence of special ferments, which are produced in the milk at the expense

* Very frequently, when cows are suffering from Foot-and-mouth disease, their milk has a most unpleasant odour. Immediately after recovery, the milk yields an unusual proportion of butter, but only a small quantity of cheese.

of the blood or modified mucus which may be mixed with it, or they are derived from without. These ferments are not volatile in some instances—cannot be conveyed by the air—but are frequently transmitted to healthy milk by means of the dairy-pans, and also during the evaporation of the milk. Damp, hot weather, an atmosphere charged with vapours, and dirty, ill-ventilated dairies, are favourable to their propagation. Where a number of cows are kept, it is important to discover those whose milk has this particular tendency. This is done by keeping the milk of each in a separate vessel. When it has been discovered, care should be taken to use the milk as soon as possible after it has been drawn, or to keep it from the other milk; and new milk-pans should be procured, or the old ones well scalded, and afterwards rinsed in a solution of carbolic acid or chloride of lime, then steeped in clean cold water. Mixing such milk with a certain quantity of curdled milk has been recommended by Haubner.

1. *Sweet-bitter Milk.*

This alteration is noticed in the milk of cows which have been feeding on certain vegetables—vine or chestnut leaves—have been receiving bitter medicines—gentian, aloes, &c.—or are affected with disease of the liver; but the modification now about to be alluded to does not depend upon these causes, as the former is present when the milk is fresh drawn, but the one to be mentioned is only apparent some time after this period—not, indeed, until the cream begins to form.

This fermentation takes place in an irregular manner, the cream itself having a yellow colour in places, like that of pea-soup, while elsewhere it is normal, though dirty-looking. The cream is also frothy, and here and there on its surface are observed drops of oil or butter already formed. It has a remarkably sweet taste, which is succeeded by a very bitter after-taste. The casein has the same peculiar property, and, in addition, where the cream has undergone these alterations the clot is not so firm. If the milk is preserved for any length of time, it has a rancid, disagreeable taste, and soon becomes putrid. It is difficult, if not impossible, to make butter from it; when

any is obtained, it is tenacious and mucus-like, has a most objectionable taste, quickly becomes rancid, and neither it nor the cheese made from the milk can be utilized.

The nature of the modifications the milk undergoes is not well understood, though they resemble those of putrid decomposition. The alteration is only observed in hot weather, and in milk kept in very bad dairies. It is to be remarked, however, that the milk of certain animals is more disposed to assume the change than that of others, and that certain pastures also appear to favour its production.

2. *Blue Milk.*

Since 1787, this condition of the milk has attracted attention. In some countries the alteration becomes at times a perfect scourge, not only in isolated farms, but in villages and entire provinces. Thus has it visited Normandy, Artois, Picardy, Holstein, the Marches of Brandenburg, &c. When the milk is first drawn, and for as many as eight, twelve, or even forty-two hours afterwards, it appears to be quite healthy ; but when the cream has formed, its surface is speckled with circular points and patches of an indigo-blue colour ; these extend beneath the cream, as well as on it, until all the milk in the vessel has become uniformly blue.

This alteration is observed only in the hot season—from the end of spring until the termination of autumn—and disappears with the first cold weather, if the milk is not kept in hot places ; if it is so kept, the alteration may be observed in winter. The milk of sheep, as well as of cattle, is liable to be so affected. Usually at the commencement of the change, it is only noticed in some vessels, appearing in the form of spots or blue streaks; these increase until the whole of the milk is invaded, and then the blue colour gradually or suddenly disappears. The casein appears to be chiefly attacked, and it undergoes a particular kind of decomposition. If the milk is kept sufficiently long, it is soon covered with a white, rough, layer of fungi ; then the blue colour becomes a bluish-gray, gray, and then a dirty hue ; at the same time the cream becomes frothy from the evolution of gas. Infusoriæ and

monads are rapidly developed in this blue milk, and these have been blamed as the cause of the alteration. They are certainly found in larger numbers in the blue patches than elsewhere. The blue colour was attributed by Braconnot to the presence of the cryptogam named *Byssus cæruleus* by Lamarck. Ehrenberg and others imagined it was produced by the *Vibrio cyanogenus;* later authorities say it is a vegetable growth—either the *Oidium lactis* or *Penicillium*, which, according to Mosler, has the power of producing blue colouring-matter in the milk; and Erdmann has shown that vibriones can form such coloured matter in protein substances. Fürstenberg has been able to preserve the fungus for more than a year; and whenever he put a small portion into fresh milk, it always rapidly developed itself into a blue mass with the casein, until the whole of the fluid was infected.

Haubner asserts that the blue colour of the cream is due solely to the tint of the casein-envelope of the fat globules. The reaction of the clotted milk is less acid than in ordinary circumstances; the casein is less consistent, and is charged with the colouring matter, which may be separated from the casein and communicated to the whey, but never to the butter. If the milk becomes alkaline, the blue colour changes to a red or yellow tint; but the addition of an acid causes the original tint to reappear.

The same authority is of opinion, from numerous investigations, that this change in the milk really consists in a diminution in the quantity of acid formed, or rather to an alkaline principle set free in the milk. A diminished coagulation of the casein, and the liquefaction and dissolution of the milk already "set," is the result.

The influence of the food in the production of the alteration has not been fully elucidated, although it appears that soil-covered or mouldy forage favours it. The use of green clover, lupuline, lucern, and other plants have been blamed, as well as green forage after the dry, scanty fodder of the winter.

As the milk of certain animals undergoes this change, while that of others submitted to the same conditions is not

affected, it would appear that the animal organism exercises some influence on its development. Congestion of, and hæmorrhage into, the udder would seem to favour its appearance, as well as temporary gastric derangement. Cows have yielded such milk for a few days after parturition.

It is certain that the agent which gives the milk its blue appearance, only exists in those parts which are so stained; if these are transferred to healthy milk, they produce the same alteration in it. Carried by the air during the evaporation of blue milk, and deposited on other milk, this agent may infect a large quantity of this fluid; and in this way the entire produce of dairies may be tainted.

As milk which has an alkaline reaction when it is fresh drawn has a particular tendency to this alteration, a change of food or pasture may remove it. Otherwise, cleanliness in every respect, well-ventilated dairies, and cleansing the milk pans thoroughly with boiling water and disinfectants, must be adopted. As the blue colour is instantly destroyed by chlorine, it has been recommended to use a solution of chloride of lime to rinse the vessels, and to wash the teats of the cattle and the hands of the milkers with it.

To prevent the change in the milk when it is drawn, it has been found advantageous to add a small quantity of whey or butter-milk, or sour milk.

This blue milk has a disagreeable taste, and has been reported as causing, particularly in children, gastric irritation, Diarrhœa, and severe febrile Gastritis. Animals, such as pigs, rabbits, and sucking-calves suffer from Diarrhœa after being fed on it.

3. *Yellow Milk.*

This alteration is different to the yellow milk already described, as the cream only is affected: the casein remaining healthy. Sometimes this change precedes that which produces blue milk; and not unfrequently we find the cream yellow, while the casein is blue. Verheyen has stated that yellow milk is due to the development of a vibrion—the *Vibrio xanthogenus*. It is contagious, like the blue milk.

4. *Green Milk.*

Berthollet was the first to notice this alteration in milk, and it has been attributed to a mixture of the blue with the yellow cream. Verheyen considered it as resulting from the simultaneous development of the blue and yellow vibriones.

5. *Red Milk.*

This is characterized by the appearance of red patches in the layer of cream, while the milk is setting. This alteration is due to cryptogamic growths—*Hyphomycetes*—and is only observed in badly-ventilated dairies in hot stifling weather.

6. *Milk from which the Cream disappears.*

With some milk, the cream which forms is covered with yellow transparent patches of variable dimensions, due to the presence of bubbles containing gas. In well-marked cases, but little butter can be made from it, and this does not keep; the milk is very insipid.

This alteration appears to be due to a ferment, and may be artificially excited by vegetable acids. Bad dairies and uncleanliness are the favouring circumstances.

7. *Vegetable Organisms in Milk.*

It is probable that several of the alterations above described are produced by vegetable organisms. It would appear that milk which is not characterized by any particular features, except the presence of large quantities of *Oidium*, has produced symptoms of Dyspepsia, cholera-like attacks, and possibly aphthous affections of the mouth in children (Parkes).

FOREIGN MATTERS IN MILK.

Milk may contain many foreign substances, some of them very dangerous. Medicaments of various kinds may pass into it. Vegetable colouring-matters, vegetable bitters, etherous compounds, different resins, &c., may all be perceived in it.

Even *mineral matters* may be carried to this secretion, and

the milk thus become the medium of conveying injurious substances to the bodies of those who consume it. When cows have received arsenic as a medicine, for instance, their milk has produced poisonous symptoms in those who ingested it.

Poisonous Plants eaten by cows may render their milk highly deleterious to people. In the Western States of America, cattle are affected with a disease commonly known as the "trembles," "milk-sickness," &c., produced, it is supposed, by their eating the leaves of the *Rhus toxicodendron*.

People, and particularly children, who partake of their milk, are seized with serious illness, marked by weakness, colic, vomiting, constipation, diminished temperature, giddiness, nervous symptoms, and fever; death may even ensue. A small quantity of milk will suffice to produce these symptoms. The flesh also possesses poisonous properties, which are not destroyed by cooking. Generally the cattle are but little, if at all, affected; fatigue will develop the symptoms in them; these consist of tremblings and convulsions, and death may result from congestion of the brain. The malady lasts from seven to ten days, and only attacks grazing cattle; it is not inoculable. Accidents of the same kind have been witnessed by Hooker in New Holland; he attributed them to the animals eating leguminous plants belonging to the *Gmopholobium* genera.

Blood may also be present, and give rise to another kind of red milk. This appears in the course of inflammation and internal lesions of the udder, as a consequence of brutal milking, during the period of rut, in sudden transitions to abundant and succulent food, as a result of the ingestion of acrid substances —such as the *Ranunculaceæ*, resinous vegetation, &c. The milk is streaked with blood while it is being drawn, and when allowed to stand in a vessel it falls to the bottom, where it may be seen in the form of globules or clots.

According to Dupont, this bloody milk causes vomiting, disorders of the stomach, and indigestion. Milk has sometimes been found to contain the chief constituents of the *urine* or *bile;* and that obtained from phthisical cattle is said to be calcareous.

MILK FROM DISEASED ANIMALS.

In the third section of this work, we have mentioned the principal diseases in which the milk is injurious. (See vol. i., pp. 405, 444, 476 ; and vol. ii., pp. 200, 288, 395.)

It only remains to add that, as a rule, milk from animals suffering from general diseases does not keep well. In some maladies it may contain pus, blood, an abnormal quantity of epithelium, different cell-forms, masses of granules, vibriones, casts of the lacteal tubes, &c.

The milk may also be the vehicle of conveying contagious maladies to other creatures or to mankind, either directly from the sick animal itself, or indirectly from other animals.

It has often been remarked that the milk of animals which are exhausted or fatigued—"heated milk," as it is called—is unhealthy for young creatures : causing Colic, Diarrhœa, and Gastro-enteritis, and adds but little to their growth.

ADULTERATIONS OF MILK.

Like almost every other article of food, milk is much adulterated: by far the most frequent ingredient, added to increase its bulk, being water. Evaporation, or ascertaining its specific gravity, will detect this adulteration.

In order to conceal this watering, which renders the milk thinner and gives it a bluish appearance, starch, dextrin, or gum are added. Iodine will detect the starch ; a little of the milk boiled with a drop or two of acetic acid, then treated with iodine, will prove the presence of dextrin ; or if acetate of lead and then ammonia be added, a white precipitate falls.

The milk is sometimes coloured with annato or turmeric to give it a richer colour. When the milk is boiled the colouring matter remains in the whey ; liquor potassæ detects turmeric.

Chalk is not unfrequently added to give thickness and colour, and to neutralize acid. When the milk stands for some time, there is a deposit at the bottom of the vessel. When this is washed, it may be tested with acetic acid, and effervescence

takes place; it may then be filtered and tested with oxalate of ammonium.

Carbonate of sodium is also added at times to destroy any acidity. The alkalinity of the fluid may give rise to suspicion. The milk must be reduced to ash, which should effervesce if this salt be present.

Cream is adulterated or made with carbonate of magnesia, tragacanth, and arrowroot. An examination of this cream with the microscope will detect the arrowroot, and round particles of carbonate of magnesia will also be observed; these disappear by adding a drop of weak acid (Parkes).

INSPECTION OF KNACKERS' ESTABLISHMENTS.

IMPORTANCE OF KNACKERS' ESTABLISHMENTS.

THE English term "knacker"—which has its equivalent in the French *equarrisseur*—is bestowed on a person who utilizes the carcasses of worn-out or diseased horses or other animals, but chiefly the former; consequently, the appellation of "horse-slaughterer" is sometimes applied to him. The establishment in which he carries on his operations is important, in a sanitary point of view; to it are carried the carcasses of animals which have died; and those which are worn-out, or are suffering from lameness or disease, are led there to be killed. The skins, flesh, hoofs, fat, and bones of these creatures are utilized to the best advantage; and what would otherwise be a source of embarrassment or a nuisance, is converted into articles of more or less value to the community. Knackers' establishments are, therefore, indispensable in or near towns or cities: their importance increasing with the population in these, and the number of animals they contain.

OBJECTION TO KNACKERS' ESTABLISHMENTS.

The nature of the operations carried on in these places, the unpleasant odours that are given off in them, and their general disagreeableness, have always caused them to be looked upon

as dangerous to the public health, and, therefore, to be kept away from populated districts. But as it is often most inconvenient to have them at any great distance from towns, and as much pain may be inflicted on lame animals in causing them to travel far, it is generally deemed advisable to allow them to be fixed in the immediate vicinity of cities, or even in their midst, when these are large. For this reason, as well as because of their importance with regard to the spread of contagious diseases, and also from humane motives, they merit the attention of municipal authorities and all those who have to do with public hygiène; and in order to have them conducted in a proper manner, and to prevent abuses, they should be placed under the inspection of veterinary surgeons, who would be held responsible for their sanitary condition, the proper treatment of the animals taken to be slaughtered, and the extension of contagious maladies from them. Such establishments are under the surveillance of sanitary veterinary surgeons throughout Germany, and are included in their annual reports.

From the investigations of Deyeux, Pariset, and Parmentier into the sanitary condition of the *clos d'équarrisage* of Paris and its vicinity, it would appear that the persons who carry on this business, as well as their families, do not suffer in health; though their establishments have generally been considered sources of infection, and places where unhealthy and disagreeable emanations were continually given off, to the injury of the people. Parent-Duchâtelet has also stated that such places do not exercise any hurtful influence on the sanitary condition of the people dwelling in them or in their vicinity; but then in Paris they were, and are, carefully conducted, and placed under proper supervision.

If the miasmata which escape from the carcasses, or from animal substances in process of putrefaction in such establishments are not very injurious, it is not the same with the virulent matters which so often find their way there. The carcasses of animals affected with Glanders and Farcy, Anthrax, putrid fevers, Rabies, Pyæmia, &c., are carried to the knacker, who, of course, incurs great risk in cutting them up.

And healthy animals kept by him for business purposes, as well as those of others, run the chance of contamination from frequenting such places.

NECESSITY FOR KNACKERS' ESTABLISHMENTS.

We have said that these establishments are absolutely necessary, in a sanitary point of view, as they remove from populous centres noisome elements of putrid infection, and matters which would otherwise be disposed of with great difficulty. With regard to veterinary sanitary science they are most important, as the carcasses of animals which have been affected with contagious maladies can be at once removed to them and rendered innocuous, and even useful: they may be buried therein, if this is deemed necessary, or transformed into useful and non-infectious substances. In this way they serve to dispose of animals which, if they did not exist, might become a serious danger to people and other creatures.

MANNER IN WHICH KNACKERS' ESTABLISHMENTS SHOULD BE CONDUCTED.

Many of the objectionable features of such establishments could be abolished if they were properly conducted, and the carcasses utilized to the best advantage by scientific means. In those places on the Continent which are under municipal or government control, they are not, and cannot be, regarded as a nuisance, because of the regulations under which they are permitted to exist. When the skin is removed and the carcass cut up, the *débris* is submitted to numerous transformations, and form new products which are very useful in many ways. Phosphorus, animal black, salts of ammonia, prussiate of potash, Prussian blue, gelatine, glue, grease, stearine, soaps, &c., as well as the bones required for different purposes, hides for leather, and other matters, can be manufactured from such remains; while that which cannot be so utilized makes an excellent manure, because of its richness in phosphates and nitrogenous matters. There can be no doubt that if the assistance of chemistry was made more available, the value of such materials would be largely increased.

In such establishments the phenomena of putrefaction should be completely suppressed, as they not only indicate a loss or deterioration of valuable matters, but are a source of insalubrity and repugnance ; and cleanliness should be strictly enjoined. This is rarely the case, however. These establishments are left a good deal to chance, and often without any control whatever ; though in this country they are generally licensed. They are frequently placed in most inappropriate situations ; unfortunate animals are kept in them for days in a starving condition before they are slaughtered ; the unscientific and crude mode of utilizing the carcasses not only causes loss, but generates foul, disgusting effluvia ; while their general filthiness—the bones, blood, fæcal and other matters allowed to lie about and putrefy, and the odour from the boilers, becomes a serious infliction to the locality in which they are fixed, and especially during the hot weather, to say nothing of the rats, insects, and other vermin which they attract.*

In the interests of public hygiène, the local authorities should be careful in not only allowing such places to be established, but in assuring themselves that they are properly constructed and conducted, by placing them under regulations, and ensuring these regulations being conformed to by the appointment of competent veterinary inspectors, in order that all objections and abuses may be removed. As it has been found that too many of these establishments in a certain district is not desirable, their number should be regulated according to the necessity for them, and they should be licensed. It is better to have them away from densely-populated localities ; though, according to Trebuchet, they need not be limited to the

* The rats are often a serious plague. They frequently swarm in these "knackeries" and the neighbourhood, and besides the destruction they commit by devouring and destroying everything they meet, they undermine buildings, and in this way may be the cause of serious accidents. At Montfaçon, near Paris, they are captured by enticing them into a special apartment of the knackery during the night, and when a large number are congregated, the apertures are closed and they are killed at leisure. In this manner sometimes as many as three thousand are slain in one night. Their skins are sold to the furriers.

suburbs of towns. They should not be commenced without permission of the authorities, and those who seek to begin them should furnish two plans for approval: one indicating the configuration of the ground, and the intended situation of the establishment with regard to dwellings and high roads; the other showing the design of the building. A month's notice of such intention should then be given to the neighbourhood, in order that objections may be heard and considered; after which the authorities or sanitary board should decide whether or not permission be granted. Their decision, of course, will depend upon various circumstances; but it may be useful here to note what are the essentials to be kept in view and insisted upon.

SITUATION OF KNACKERS' ESTABLISHMENTS.

A knacker's establishment should be situated outside the town, at a distance of not less than half-a-mile from any dwellings, and in the neighbourhood of a river or stream if possible, in order to have sufficient water, and to get rid of that which is unclean; preference should be given to a somewhat elevated and airy situation, and low-lying places are to be avoided; a gravelly subsoil is to be recommended. The premises should be enclosed by a high wall with ventilating apertures; or a palisade or quickset hedge. A number of trees around such an establishment is very advantageous. The site should be some distance from public roads, not only because of the unpleasant odours, but also because horses frequently refuse to pass these buildings. The extent of such an establishment is subordinate to the requirements of the locality, but it can scarcely be too large.

INTERIOR OF KNACKERS' ESTABLISHMENTS.

In the application for permission to build such a place, mention should be made by the applicant of the manner in which he intends to carry on his business, and the substances he is desirous of manufacturing; he should also indicate the internal arrangements of the building, as this may be a matter of

some importance. The establishment should consist of the slaughter-house proper: buildings for the various processes necessary in utilizing the carcasses, stables for horses, sheds for carriages, store-houses, water arrangements, manure pits, a space of ground for burying carcasses or *débris*, and buildings for special purposes.

The slaughter-house is where the animals brought alive to the establishment are killed, skinned, eviscerated, cut up, and the flesh removed from the bones. It may be roofed or not, but it should be well lighted and ventilated; the floor ought to be of stone or cement, and the walls of the same for at least four feet from the ground; or they should at any rate be covered with oil paint, so that they can be well washed with water. The animals killed or brought in dead should be promptly disposed of, so that at the end of the day no remains be left in this place, and the floor and walls be well cleansed with water.

The stables to accommodate the animals brought for slaughter should be separate from those intended for the knackers' horses; they should be differently allotted: (1.) For those animals which cannot be killed at once;* (2.) For those which, being suspected of suffering from contagious diseases, may be kept isolated for a certain period: such stables being under the direct surveillance of the veterinary surgeon. Should dogs be also utilized in such an establishment, separate kennels are necessary.

The sheds containing the carriages for carrying the carcasses of dead animals, should be apart from those for conveying the ordinary products and materials of the establishment.

The buildings for manufacturing articles from the carcasses of the animals will, of course, vary according to the nature of the preparations. Boiling is usually the first step in this direction; it should be done in closed boilers sufficiently large to contain the quarters and trunks of four or five carcasses. The furnaces and chimneys should be properly arranged, and every

* It is abominably cruel to leave unfortunate animals exposed to the weather for days and nights without food, as is so frequently the case in knackers' yards in this country.

precaution taken to destroy the odour given off in this process. The boiling should continue for eight or nine hours, when the fat may be skimmed off the surface, received into iron vessels, and finally poured into barrels. The water is sometimes thrown away, but it may also be utilized. The cooked flesh is easily detached from the bones; in proper establishments it is pressed by machinery, which expels the grease yet remaining in it, and it is then made into prussiate of potash, or put to one side as manure. The bones are sorted by hand, and collected for the manufacture of phosphorus, animal black, or ammoniacal compounds. In less suitable establishments the boiling process is badly conducted, and the smells generally most repulsive; much of the flesh is sold in a raw state to feed dogs, pigs, and fowls.

There should be drying houses where skins, and parts intended for the manufacture of gelatine, are dried. When this is done in the hot-air chambers, the odour is much diminished, and time is gained.

The substances kept in the stores should not be capable of putrefaction. Hoofs and horns may be kept in cellars, hair and bristles are best kept in lofts, and the bones preserved in a dry place.

There ought to be an abundance of water, and free use made of it; that which contains much animal matter being conveyed by drains into suitable receptacles, where it may be disinfected and used as liquid manure.

The ground for burying *débris* which cannot be utilized, or the infected carcasses of animals which are dangerous or useless, should be attached to the establishment, and enclosed by a wall or hedge. It should be so large that the same pit need not be opened within three or four years.

The other buildings for manufacturing the remaining products should be convenient to each other.

The *débris*, contents of the stomach and intestines, the internal organs, blood, &c., should be converted into manure by suitable processes, without giving off any offensive odour.

KNACKERS' CARTS.

The vehicles for carrying the carcasses of dead animals to the knacker's establishment, should be so constructed as not to allow any fluids to escape, neither should the carcass be seen. Nothing can be more offensive or disgusting than the carts used in this country, which not only display the ghastly figure of the dead animal, often partially dissected, but leave a track of blood and filth behind them. They should be lined with zinc or sheet iron, and kept clean and odourless by washing and disinfection.

Carcasses, as well as animals intended for slaughter, should only, if possible, be conveyed to these establishments during the night, when the roads and streets are not so busy and crowded. This is more particularly necessary in the case of contagious diseases, where delay in transit might tend to spread the infection. Knackers should not be accompanied on these missions by dogs.

DUTIES OF THE KNACKER.

The knacker should be bound, under certain guarantees, to conform to the prescribed regulations. He should remove, within twenty-four hours after he has received notice, the carcasses of dead animals, or those intended for slaughter, with care. He should keep a register of these animals, and submit it for the examination of the veterinary inspectors when necessary. This register must contain the date, species, sex, and colour of the animal, and the name of the owner; it should have a column of remarks, wherein the nature of the disease or the cause for slaughter is entered. Not only should he most scrupulously carry out the sanitary measures relating to his business and establishment, but he should also, without delay, report every case which leads him to suspect the existence of a contagious disease; and, unless with special permission, he ought not to cut up the carcasses of suspected animals, or those which have died of contagious maladies, when the veterinary inspector is not present. Any neglect of this declaration, or any clandes-

tine traffic in the carcasses of such animals, should be punished by suspension of his licence.

USE OF THE FLESH FROM KNACKERS' ESTABLISHMENTS AS FOOD.

The flesh from these establishments should never be used for human food. When horses are to be utilized in this way, they should be slaughtered in special establishments, after they have been inspected by veterinary surgeons, and dressed like ordinary meat: but with the skin or hoofs attached, bearing the inspector's mark. They should not be killed for this purpose in "knackeries."

With regard to the utilization of this flesh for other animals —dogs, cats, pigs, menagerie animals, and fowls—there cannot be any objection, and particularly if the flesh is cooked. When uncooked, the flesh of glandered or farcied horses, mules, or asses, or animals which have been affected with Anthrax or Rabies, or some parasitic diseases, should not be used as food.

With regard to pigs, there has been much discussion as to whether these animals should be so fed; and, seeing that in nearly every knacker's yard pigs are kept (though in some towns on the Continent this is prohibited), it is important that the matter be inquired into. There can be no doubt that fattening pigs in such places is calculated to generate a strong antipathy to their flesh; and considering that in these places rats generally swarm, that these are often infested with trichinæ, and that they are devoured by pigs, there may be reason to apprehend danger. But we have no proof that the flesh of such pigs—always excepting, of course, that containing trichinæ or cysticerci—has received any pernicious quality through such feeding. The veterinary school at Alfort has a piggery attached, and for many years the pigs have often been almost exclusively fed on the flesh and offal of horses, which they preferred to any other kind of food—often leaving a vegetable diet to eat such flesh. They throve well on it, and their flesh was none the worse. Magne says that the latter was

not so firm, though more juicy, and more difficult to preserve, perhaps; but these defects were obviated by putting them on a meal diet about fifteen days before they were killed. Payen and Richard have remarked on the powerful influence that animal food exercises on the weight of pigs, and especially on the production of fat. Fowls, and particularly ducks, fatten very quickly on horseflesh, which is given to them either chopped very fine along with their other food, or in small pieces alone.

There appears to be no reason, then, to interdict the use of this flesh, nor to prohibit such animals being kept at these establishments, so long as the food does not contain any virulent principles or parasites which may render their flesh dangerous to man; and so long as they are kept in places altogether apart from the slaughter-house. These animals, when fattened, should also be sent to the market alive; the knacker should not be the butcher.

The sale of the flesh of animals which have died or been killed beyond these establishments should not be tolerated, even when it is for dogs; as there is a chance of its only too frequently finding its way to the butcher's stall, or into the sausage-maker's manufactory.

APPENDIX.

THE CONTAGIOUS DISEASES (ANIMALS) ACT, 32 & 33 VICT., AND ORDERS, FOR GREAT BRITAIN.

CHAP. 70.

A.D. 1869.

An Act to consolidate, amend, and make perpetual the Acts for preventing the introduction or spreading of Contagious or Infectious Diseases among Cattle and other Animals in Great Britain. [9th August, 1869.]

WHEREAS it is expedient to confer on Her Majesty's Most Honourable Privy Council power to take such measures as may appear from time to time necessary to prevent the introduction into Great Britain of contagious or infectious diseases among cattle, sheep, and other animals, by prohibiting or regulating the importation of foreign animals, and it is further expedient to provide against the spreading of such diseases in Great Britain, and to consolidate and amend and make perpetual the Acts relating thereto, and to make such other provisions as are contained in this Act:

Be it therefore enacted by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:

PART I.—PRELIMINARY.

Short title.

1. This Act may be cited as the Contagious Diseases (Animals) Act, 1869.

Extent of Act.

2. This Act shall not extend to Ireland.

Division of Act into parts.

3. This Act is divided into parts, as follows:—

PART I.—Preliminary.
PART II.—Local authorities.
PART III.—Foreign animals.
PART IV.—Discovery and prevention of disease.
PART V.—Slaughter in cattle plague: compensation.
PART VI.—Orders of Council and of local authorities.
PART VII.—Lands.
PART VIII.—Expenses of local authorities.
PART IX.—Offences and legal proceedings.
PART X.—Scotland.

Repeal of Acts in schedule.

4. The Acts described in the first schedule to this Act are hereby repealed, but this repeal shall not extend to Ireland, or affect the past operation of any of those Acts, or affect any order

of Her Majesty in Council made, or any order or regulation of the Privy Council or of a local authority made, or any licence granted, or any committee or sub-committee constituted, or any appointment made, or any right, title, obligation, or liability accrued, or any rate or mortgage made, or the validity or invalidity of anything done or suffered, under any of those Acts, before the passing of this Act; nor shall this repeal interfere with the institution or prosecution of any proceeding in respect of any offence committed against, or any penalty or forfeiture incurred under, any of the Acts repealed by this Act, or any order or regulation made thereunder, or take away or abridge any protection or benefit conferred or secured by any of those Acts in relation to anything done thereunder before the passing of this Act; and, notwithstanding the repeal by this Act of any of those Acts, every local authority constituted thereby or thereunder shall (subject to any provision of this Act altering the local authority or the constitution thereof in any case) continue as if this Act had not been passed; and every such order, regulation, licence, committee, sub-committee, and appointment as aforesaid shall continue and be as if this Act had not been passed, but so that the same may be revoked, altered, or otherwise dealt with under this Act as if the same may be revoked, altered, or otherwise dealt with under this Act as if the same had been made, granted, or constituted under this Act.

Definition, &c. of Privy Council.

5. In this Act, the term "the Privy Council" means the lords and others of Her Majesty's Most Honourable Privy Council.

All or any powers by this Act conferred on the Privy Council may be exercised by those lords and others or any two or more of them.

Powers by this Act conferred on the Privy Council may, as regards the making of orders affecting only specified ports, towns, or places, or parts thereof, and as regards the issuing and revocation of licences under any Order of Council, be exercised by the Lord President of the Council or one of Her Majesty's Principal Secretaries of State.

Interpretation of terms as to animals, &c.

6. In this Act—

The term "cattle" means bulls, cows, oxen, heifers, and calves:

The term "animal" means, except where it is otherwise expressed, cattle, sheep, goats, and swine:

The term "foreign," as applied to cattle or animals, means brought from any place out of the United Kingdom:

The term "cattle plague" means the rinderpest, or disease commonly called the cattle plague:

The term "contagious or infectious disease" includes cattle plague, pleuro-pneumonia, foot-and-mouth disease, sheep-pox, sheep-scab, and glanders,* and any disease which the

* By an Order of Council (365), dated 30th June, 1873, it was enacted that, after the second day of July, 1873,

"Farcy is hereby declared to be a contagious disease for the purposes of the Act of 1809, and all the provisions relating to contagious or infectious disease contained in any Order of Council for the time being in force thereunder shall also apply to farcy.

"Where a local authority is authorized by the Privy Council to make regulations for the purpose of preventing the spread of glanders and

A.D. 1869.

Privy Council from time to time by order declare to be a contagious or infectious disease for the purposes of this Act:

The term "railway company" includes a company or person working a railway under lease or otherwise:

The term "person" includes a body corporate or unincorporate.

7. In this Act—

Definition of boroughs and other places.

The term "borough" means a place which is for the time being subject to the Act of the session of the fifth and sixth years of the reign of King William the Fourth (chapter seventy-six), "to provide for the regulation of municipal corporations in England and Wales," or which is a town or place having under any general or local Act of Parliament or otherwise a separate police establishment:

The term "county" does not include a county of a city or county of a town, but includes any riding, division, or parts of a county, having a separate commission of the peace:

The term "metropolis" includes all parishes and places in which the Metropolitan Board of Works have or had power to levy a main-drainage rate.

For the purposes of this Act, the liberty of St. Albans, the liberty of the Isle of Ely, and the soke of Peterborough shall respectively be deemed separate counties, but all other liberties and franchises of counties shall be considered as forming part of the county by which they are surrounded, or if partly surrounded by two or more counties, then as forming part of that county with which they have the longest common boundary.

Every place that is not a borough, a county, or part of the metropolis as respectively defined in this Act, or is not separately mentioned in the second schedule to this Act, shall be deemed to form part of a county as defined in this Act to the county rate whereof it is assessed, or if it is not so assessed, then of the county within which it is situate.

Effect of schedules.

8. The schedules to this Act shall be construed, and have effect as part of this Act.

Part II.—Local Authorities.

Local authorities, &c., in schedule.

9. For the purposes of this Act, the respective districts, authorities, rates, or funds, and officers described in the second schedule to this Act, shall be the district, the local authority, the local rate, and the clerk of the local authority.

Local authority in city of London.

10. Notwithstanding anything in this Act or the second schedule thereto. within the city of London and the liberties thereof

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farcy, or either of them, the local authority may make regulations for the following purposes, or any of them :—

"For prohibiting or regulating the movement out of any field, stable, shed, or other premises in which glanders or farcy has been found to exist, or any horse that is, or has been, affected with glanders or farcy, or that has been in the same field, stable, shed, or other premises with or in contact with any horse affected with glanders or farcy."

Another Order in Council, dated 7th of August, 1874, states that this of 1873 "Shall have effect as if in Article Two thereof the words Glanders and Farcy were substituted for the words contagious and infectious.

The Committee on this Act, in August, 1873, recommended "that the slaughter of horses affected with glanders should be compulsory, but that payment should be made to the owner for the value of the carcasses.

the mayor, aldermen, and commons of the city of London shall be the local authority, and the town clerk shall be the clerk of the local authority, and the consolidated rate shall be the local rate, but the city of London and the liberties thereof shall nevertheless be deemed part of the metropolis for the purposes of the local rate described in the second schedule to this Act in relation to the metropolis.

Appointment of committees.

11. With respect to committees of a local authority, the following provisions shall have effect :—

(1.) A local authority shall form a committee or committees, and may delegate to any such committee all or any powers conferred on the local authority by this Act, except the power to make a rate :

(2.) A local authority may from time to time revoke or alter any power given by them to a committee :

(3.) A local authority may appoint and designate any such committee as their executive committee for the purposes of this Act :

(4.) Such an executive committee shall have all the powers of the local authority under this Act, except the power to make a rate, and may appoint a sub-committee or sub-committees, and delegate to them all or any powers of the executive committee, with or without conditions or restrictions, and from time to time revoke or alter any such delegation, and fix the quorum, and add to or diminish the number of the members, or otherwise alter the constitution of a sub-committee, and lay down rules for the guidance of a sub-committee, who shall act accordingly.

(5.) Proceedings of a committee or sub-committee shall not be invalidated by any vacancy in the committee or sub-committee, or, in case of a committee appointed by general or quarter sessions of a county, by the termination of the sessions at which they were appointed :

(6.) In case of the formation of two or more committees, they shall act according to rules laid down for their guidance by the local authority :

(7.) The regulations contained in the third schedule to this Act shall have effect with respect to the committees and sub-committees.

Inspectors and Officers.

Appointment of inspectors and other officers by local authorities.

12. Every local authority shall from time to time appoint so many inspectors and other officers as appear to the local authority necessary for the execution of this Act, and shall assign them such duties and award them such salaries or allowances as the local authority think fit, and may at any time revoke any appointment so made, but so that every local authority shall at all times keep appointed at least one inspector.

Removal of inspectors.

13. The Privy Council, if satisfied on inquiry that an inspector appointed by a local authority is incompetent, or has been guilty of misconduct or neglect in the discharge of his duty, may, if they think fit, direct his removal, and thereupon he shall cease to be an inspector for the purposes of this Act.

Reports to

14. Every local authority, and every inspector appointed by a

A.D. 1869. Privy Council, &c.

local authority, shall make such reports to the Privy Council as the Privy Council from time to time require.

Part III.—Foreign Animals.

Power to define parts.

15. The Privy Council may from time to time by order define the limits of ports for the purposes of this part of this Act.

Power to prohibit landing of foreign animals.

16. The Privy Council may from time to time by order, in relation to foreign animals, or to any specified kind of foreign animals, or to foreign animals, or any specified kind thereof, brought from any specified country or place, prohibit the landing thereof either generally, or in any specified port, or in any defined part thereof, or elsewhere than in some specified port or ports, or than in some defined part or parts thereof.

This section shall extend to horses and other animals not within the definition of animals in this Act.

Power to apply regulations in schedule to landing in specified cases.

17. The Privy Council may from time to time by order apply to the landing, either generally, or with specified exceptions, or in some specified port, or in some defined part thereof, of foreign animals, or of any specified kind of foreign animals, or of foreign animals, or any specified kind thereof, brought from any specified country or place, and to the movement and disposal thereof when landed, the regulations contained in the fourth schedule to this Act, or any of them.

Power to vary regulations.

18. The Privy Council may from time to time by order, in relation to foreign animals, or to any specified kind of foreign animals, or to foreign animals, or any specified kind thereof, brought from any specified country or place, add to or vary the regulations contained in the fourth schedule to this Act.

Provision respecting animals within port, &c.

19. Where the regulations contained in the fourth schedule to this Act, or any of them, (with or without addition or variation,) are in operation in respect of a port or a defined part thereof, then all animals for the time being within that port or defined part shall, subject to any order of the Privy Council to the contrary, be deemed foreign animals, and the same regulations shall apply thereto accordingly.

Power to impose quarantine.

20. The Privy Council may from time to time by order make such regulations as they think expedient for imposing conditions on the landing of or for subjecting to inspection or to quarantine foreign animals, or any specified kind of foreign animals, or foreign animals, or any specified kind thereof, brought from any specified country or place.

This section shall extend to horses and other animals not within the definition of animals in this Act.

Punishment for wrongful landing, &c.

21. If any person lands or attempts to land any foreign animal (including any horse or other animal not within the definition of animals in this Act) in contravention of any order of the Privy Council, the animals shall be forfeited in like manner as goods the importation whereof is prohibited by the Acts relating to the Customs are liable to be forfeited; and the person so offending shall be liable to such penalties as are imposed on persons importing or attempting to import goods the importation whereof is prohibited by the Acts relating to the Customs, without prejudice to any proceeding against him under this Act or any such

order, but so that no person be punished twice for the same offence. A.D. 1869.

Article 9, of Order in Council (341), dated December 20, 1871, specifies that "Animals landed from a vessel shall, on a certificate of an inspector appointed by the Privy Council in that behalf, certifying to the effect that the foregoing regulations, or some or one of them, have not or has not been observed in the vessel, be detained at the landing place, or in lairs adjacent thereto, until the Privy Council otherwise direct."

Return of diseases among foreign animals to be published in London Gazette.

22. There shall be published in the London Gazette once in every month, under the direction of the Privy Council, a return of the number of foreign animals brought by sea to any port in Great Britain which on inspection on landing within the then last preceding month have been found to be affected with any contagious or infectious disease, specifying the disease and the ports from which and to which such animals are brought, and the mode in which such animals have been disposed of.

Power to provide wharves, lairs, &c.

23. A local authority may provide, erect, and fit up wharves, lairs, sheds, markets, houses, and places for the landing, reception, sale, and slaughter of foreign animals.

Incorporation of Markets, &c., Clauses Act, 1847.

24. There shall be incorporated with this part of this Act The Markets and Fairs Clauses Act, 1847; and for the purposes of the application and construction of that Act in conjunction with this part of this Act any place provided by a local authority under this part of this Act for the landing, reception, sale, or slaughter of foreign animals shall be deemed a market, and this part of this Act shall be deemed the special Act, and the prescribed limits shall be deemed to be the limits of the lands acquired for the purposes of this part of this Act; and byelaws shall be approved by the Privy Council, which approval shall be sufficient, without any other approval or any allowance thereof (notice of application for such approval being nevertheless given, and proposed byelaws being published before application for approval, in like manner as under that Act notice of application for allowance and publication before that application are required to be made).

Charges for use of wharves, &c.

25. A local authority may charge for the use of any wharf, lair, shed, market, house, or place provided by them under this part of this Act such sums as they from time to time by byelaws appoint.

Power to give as security for borrowed money, charges, estates, &c.

26. A local authority, on exercising for the purposes of this part of this Act the borrowing powers vested in them under this Act, may, if they think fit, give as security for repayment of money borrowed with interest (either together with the local rate, if any, or separately therefrom) the charges which they are authorized to make under this part of this Act, and any estates, revenues, or funds belonging to them and not otherwise appropriated by law.

Separate account and application of money received.

27. All money received by a local authority from charges made by them under this part of this Act shall be carried to a separate account, and shall be applied in payment of interest on money borrowed by them for the purposes of this part of this Act, and in repayment of the principal thereof, and subject thereto towards discharge of expenses incurred by them in the execution of this Act.

(*By an Order in Council* (342) *of December* 20*th*, 1871, *additional regulations are laid down with regard to Foreign Cattle, and which were to take effect from the* 31*st of that month* :—

2. This Order may be cited as the Foreign Animals Order of 1871.
3. This Order extends to Great Britain only.
4. In this Order—

The Act of 1869 means The Contagious Diseases (Animals) Act, 1869 :

A defined part of a port means a part of a port defined by a special Order of the Privy Council in pursuance of Regulation 2 of the Fourth Schedule to the Act of 1869 :

Landing-place for slaughter means a landing-place within a defined part of a port :

Master includes any person having the charge or command of a vessel :

Other terms, except where otherwise expressed, have the same meaning as in the Act of 1869.

5. Foreign animals shall not be landed at any place except the ports comprised in the First Schedule to this Order.

6. Foreign animals landed at any port shall be landed in such manner, within such times and subject to such supervision and control, as the Commissioners of Her Majesty's Customs from time to time direct, and when landed shall be placed under the charge of a Veterinary Inspector appointed in that behalf by the Privy Council, and shall be dealt with in accordance with the instructions from time to time given by the Privy Council.

7. Foreign animals shall, except as in this Order provided, be detained for at least twelve hours after landing, in some lair or other proper place adjacent to the landing-place, and shall be inspected by the Veterinary Inspector of the Privy Council.

8. Where one part of a cargo of foreign animals is landed at one place, and another part is landed at another place, or where parts of a cargo of foreign animals are landed at different times at the same place, twelve hours' detention shall commence from the time of the landing of the last animal of the cargo ; and if any contagious or infectious disease is detected in any animal of the cargo, every animal in each separate part of the cargo shall be dealt with as if the disease had been detected in an animal in each separate part.

9. Where any foreign animal forming part of one cargo has not been kept separate from any foreign animal forming part of another cargo, all the foreign animals forming such cargoes shall be treated as forming one cargo.

10. A Veterinary Inspector of the Privy Council may detain, for any period that he thinks necessary or proper, any foreign animals (including horses and other animals not within the definition of animals in the Act of 1869), which he has reason to suspect are affected with any contagious or infectious disease, or may introduce any such disease.

11. If any foreign sheep or swine are found to be affected with any contagious or infectious disease (except cattle plague), such sheep or swine shall be kept separate from those of the same cargo not found to be so affected ; and the slaughter of those not found to be so affected may, with the permission of the Veterinary Inspector of the Privy Council, be begun at any time before the expiration of the twelve hours' detention, and be continued without intermission.

12. No animal, carcase, hide, meat, or offal, and no hay, straw, litter, or other thing commonly used for food of animals, or otherwise for or about animals, and no dung, shall be removed from the lair or other place adjacent to the landing-place where foreign animals are detained, except with the permission of the Veterinary Inspector of the Privy Council, and, if the Inspector is of opinion that any such animal or thing as aforesaid may introduce any contagious or infectious disease, the same shall be slaughtered, destroyed, or otherwise dealt with in accordance with the instructions from time to time given by the Privy Council.

13. Subject to any provision in this or any other Order to the contrary, all the regulations in the Fourth Schedule to the Act of 1869 shall apply to cattle brought from any port or any of the countries comprised in the Second Schedule to this Order; and, subject as aforesaid, all such cattle shall be slaughtered within ten days after the landing thereof, exclusive of the day of landing.

14. The landing of foreign cattle elsewhere than at a landing-place for slaughter shall be subject to the following conditions :—

First. That the vessel in which they are imported has not, within three months before taking them on board, had on board any cattle exported from any port of any of the countries comprised in the Second Schedule to this Order.

Secondly. That the vessel has not, since taking on board the cattle imported, entered any port of any of those countries.

Thirdly. That the cattle imported have not, while on board the vessel, been in contact with any cattle exported from any port of any of those countries.

And foreign cattle shall not be landed elsewhere than at a landing-place for slaughter, unless and until—

(1.) The owner or charterer of the vessel in which they are imported, or his agent in Great Britain, has entered into a bond to Her Majesty the Queen, in a sum not exceeding one thousand pounds, with or without a surety or sureties, to the satisfaction of the Commissioners of Her Majesty's Customs, conditioned for the observance of the foregoing conditions in relation to cattle to be landed under this Order from the vessel, and

(2.) The master of the vessel has on each occasion of importation of cattle therein satisfied the Commissioners of Her Majesty's Customs or their proper officer, by declaration made and signed or otherwise, that none of the cattle then imported therein have been exported from any port of any of the countries comprised in the Second Schedule to this Order, and that the foregoing conditions have been observed in relation to all the cattle then imported therein.

15. Foreign animals landed from a vessel elsewhere than at a landing-place for slaughter, shall not be moved therefrom or be allowed to come in contact with any other animals until they have been examined by the Veterinary Inspector appointed in that behalf by the Privy Council, and according to the result of such inspection the following consequences shall ensue :—

(1.) If the Inspector certifies that all the animals landed from the vessel are free from contagious or infectious disease, they shall thereupon cease to be deemed foreign animals.

(2.) If the Inspector certifies, with respect to any one or more of the animals landed from the vessel, that it or they is or are affected with any contagious or infectious disease, all the animals then im-

ported in the vessel shall be slaughtered or otherwise dealt with in accordance with the instructions from time to time given by the Privy Council.

16. The regulations of the Fourth Schedule to the Act of 1869 shall not apply to any milch cow brought from a port of any of the countries comprised in the Second Schedule to this Order, provided the Commissioners of Her Majesty's Customs are, on each occasion of the same being so brought, satisfied that the same has been taken from Great Britain to that port, and has not been landed at that port or at any other port of any of those countries; and in relation to the landing, on any occasion, of any such milch cow in Great Britain elsewhere than at a landing-place for slaughter, the condition that the vessel has not, since taking on board the cattle imported, entered any port of any of those countries, shall not operate, provided the Commissioners of Her Majesty's Customs are, on each occasion, satisfied as aforesaid; and the twelve hours detention may be enforced on board the vessel.

17. In the case of a foreign animal which is brought in a vessel from any country other than those comprised in the Second Schedule to this Order, but which was not taken on board for importation into Great Britain, the twelve hours detention may be enforced on board the vessel.

18. If a vessel arriving at a port has on board the carcase of a foreign animal (including a horse) which was taken on board for the purpose of importation, but has died on the voyage, the master of the vessel shall, immediately on arrival, report the fact to the Principal Officer of Her Majesty's Customs at the port.

No such carcase shall be landed or discharged from the vessel without the permission in writing of the Principal Officer.

19. Where it appears to the Principal Officer of Her Majesty's Customs at a port, with respect to any foreign animal (including a horse or other animal not within the definition of animals in the Act of 1869,) or any hay, straw, fodder, or other article, brought by sea to the port, that contagion or infection may be thereby conveyed to animals, he may seize and detain the same, and he shall forthwith report the facts to the Commissioners of Her Majesty's Customs, who may give such directions as they think fit, either for the slaughter or destruction or the further detention thereof, or for the restoration thereof to the owner on such conditions, if any, (including payment by the owner of expenses incurred by them in respect of detention thereof,) as they think fit.

20. Foreign cattle, sheep, goats, and swine, in a defined part of a port (except sheep, goats, and swine in a defined part of the Port of London) shall be marked as follows:—

Cattle.—By clipping a broad arrow, about five inches long, on the left quarter (in addition to clipping the hair off the end of the tail, as prescribed by Regulation 4 of the Fourth Schedule to the Act of 1869).

Sheep and Goats.—By clipping a broad arrow, about four inches long, on the forehead.

Swine.—By printing a broad arrow, about three inches long on the left side with the following composition, namely:—Rosin, five parts; oil of turpentine, two parts; and red ochre, one part; melted and used warm.

21. Where any regulation relating to foreign animals is in operation, the Local Authority and all constables and police officers shall assist the Veterinary Inspector of the Privy Council to carry the same into effect

and to enforce the same, and shall do or cause to be done all things from time to time necessary for the effectual execution of the same.

22. A person for the time being appointed by the Privy Council an Inspector for the purposes of the Act of 1869 shall have, at every port, all such powers, authorities, and privileges as a Veterinary Inspector specially appointed by the Privy Council for the inspection of foreign animals has at any specified port.

23. In paragraph 5 of the Fourth Schedule to the Act of 1869 the words Privy Council shall be deemed to be substituted for the words Commissioners of Customs.

24. For the explanation and amendment of certain Orders of Council having a local operation only, the following provisions shall have effect :—

(1.) Any defined part of a port for cattle shall be deemed a defined part of the same port for animals :

(2.) In the Order of the first day of October, one thousand eight hundred and seventy, defining parts of the Port of Southampton, the words the Veterinary Inspector appointed in that behalf by the Privy Council shall be deemed to be substituted for the words an Officer of Customs.

In an Order in Council of August 7th, 1874, cited as the "Animals (Amendment) Order of 1874," the words of which were to have the same meaning as in the Act of 1869, it is stated that (3) the Foreign Animals' Order of 1871 "has and shall have effect subject and by way of supplement to the Animals' Order of 1871 ; and nothing in the Foreign Animals' Order of 1871 interferes or shall interfere with the execution or discharge by the Local Authority, or the inspector or other officer of the Local Authority, of any power or duty conferred or imposed on them or him by the Act of 1869, or by any Order of Council." It also states that (4) "Regulation Seven of the Fourth Schedule to the Act of 1869, shall apply in every case where a vessel comes into port having on board foreign animals maimed or injured on the voyage ; but, notwithstanding anything in Section Nineteen of the Act of 1869, any animals being at any time within such port shall not be deemed foreign animals, by reason only of anything in this Order."

An Order in Council (351) further regulates the importation of cattle from Russia. It is dated July 19th, 1872, and specifies :

1. This Order shall take effect from and immediately after the nineteenth day of July, one thousand eight hundred and seventy-two ; and words in this Order have the same meaning as in the Act of 1869.

2. Cattle brought from any place in the dominions of the Emperor of Russia shall not be landed at any port or place in Great Britain.

3. The following Articles brought from any place in the dominions of the Emperor of Russia shall not be landed at any port or place in Great Britain :—

Manure ; or hay.

4. The following articles brought from any place in the dominions of the Emperor of Russia shall not be landed at any port or place in Great Britain, except at the ports at which foreign animals may be landed, and shall not be removed from the place where landed without a certificate of an Inspector of the Privy Council, certifying that such articles are not likely to introduce any contagious or infectious disease :—

Meat ; hides ; fat ; hoofs : or horns.

5. Subject to the provisions contained in the Orders of Council relating to the ports of Granton and Leith, dated the tenth day of August, one

thousand eight hundred and sixty-nine, and in the Order of Council relating to the port of Southampton, dated the first day of October, one thousand eight hundred and seventy, all the regulations in the Fourth Schedule to the Act of 1869 shall apply to sheep and goats brought to Great Britain from any place in the dominions of the Emperor of Russia, and landed in Great Britain, and all such sheep and goats shall be slaughtered within ten days after the landing thereof, exclusive of the day of landing: Provided nevertheless, that cattle, sheep, or goats being or having been on board any vessel at the same time with any cattle brought from any place in the dominions of the Emperor of Russia, shall not be landed at any port or place in Great Britain.

6. Notwithstanding any Order of Council to the contrary, no sheep or goats brought from any place in the dominions of the Emperor of Russia, and landed within the port of London, shall be moved alive out of any part of the port defined as a part within which foreign cattle may be landed for slaughter.

An Order of Council (364), dated July 11, 1873, regulates the traffic in cattle with Schleswig-Holstein. It says :—

1. This Order shall take effect from and immediately after the twenty-third day of June, one thousand eight hundred and seventy-three, and shall cease to have effect from and immediately after the thirtieth day of November, one thousand eight hundred and seventy-three.

2. This Order may be cited as the Schleswig-Holstein Order of 1873.

3. This Order extends to Great Britain only.

4. In this Order—

The Act of 1869 means The Contagious Diseases (Animals) Act, 1869 :

A defined part of a port means a part of a port defined by a special Order of the Privy Council in pursuance of Regulation 2 of the Fourth Schedule to the Act of 1869 :

Landing-place for slaughter means a landing-place within a defined part of a port :

Master includes any person having the charge or command of a vessel :

Other terms have the same meaning as in the Act of 1869.

5. Notwithstanding anything in The Foreign Animals Order of 1871, the regulations in the Fourth Schedule to the Act of 1869 shall not apply to cattle brought from a port in either of the parts of the Empire of Germany respectively known as Schleswig and Holstein.

6. Cattle brought from a port of Schleswig or of Holstein shall not be landed elsewhere than at a landing-place for slaughter, unless and until the owner, agent, or charterer of the vessel in which they are brought has received the special permission of the Privy Council to employ the vessel in the trade of importation of cattle from ports of Schleswig and of Holstein or of either of them under this Order.

7. The landing of cattle brought from a port of Schleswig or of Holstein, elsewhere than at a landing-place for slaughter, shall be subject to the following conditions :—

First. That the vessel in which they are imported has not, within three months before taking them on board, had on board any cattle exported from any port in any part of the Empire of Germany, other than Schleswig or Holstein, or from any port of any of the following countries, namely :—

The Dominions of the Emperor of Russia.
The Austrian-Hungarian Empire.
The Dominions of the Sultan.

The Dominions of the King of Italy.
The Dominions of the King of the Hellenes.
Belgium.
France.

Secondly. That the vessel has not, since taking on board the cattle imported, entered any such port as aforesaid.

Thirdly. That the cattle imported have not, while on board the vessel, been in contact with any cattle exported from any such port as aforesaid.

Fourthly. That the cattle imported are accompanied by a declaration and certificates, such as are indicted in the forms set forth in the schedule to this Order, or to the like effect.

8. Further, cattle brought from a port of Schleswig or of Holstein shall not be landed elsewhere than at a landing-place for slaughter, unless and until—

(1.) The owner or charterer of the vessel in which they are imported, or his agent in Great Britain, has entered into a bond to Her Majesty the Queen, in a sum not exceeding one thousand pounds with or without a surety or sureties, to the satisfaction of the Commissioners of Her Majesty's Customs, conditioned for the observance of the foregoing conditions in relation to cattle to be landed under this Order from the vessel; and

(2.) The master of the vessel has on each occasion of importation of cattle therein satisfied the Commissioners of Her Majesty's Customs, or their proper officer, by declaration made and signed or otherwise, that none of the cattle then imported therein have been exported from any port in any part of the Empire of Germany, other than Schleswig or Holstein, or from any port of any of the other countries named in Article 7 of this Order, and that the foregoing conditions have been observed in relation to all the cattle then imported therein.

9. If the Veterinary Inspector of the Privy Council is of opinion, on the examination of any cattle imported under this Order, that the declaration accompanying the cattle is untrue in any particular, as regards any one of the cattle in the vessel, then all the animals in the vessel shall be detained and dealt with in accordance with instructions from time to time given by the Privy Council.

10. If the declaration accompanying any cattle imported under this Order is untrue in any particular, as regards any one of the cattle to which it relates, the master of the vessel shall be guilty of an offence against this Order, unless he shows to the satisfaction of the Justices before whom he is charged, that he did not know of the same being so untrue, and that he could not with reasonable diligence have obtained such knowledge.

11. Subject to the provisions of this Order all the provisions of The Foreign Animals Order of 1871 shall continue to apply to cattle brought from a port of Schleswig or of Holstein.

SCHEDULE.

Declaration and Certificates.

DECLARATION.

I, *A.B.*, of , being the Agent for the owners [*or* charterers] of the vessel , of , hereby solemnly and sincerely declare to the best of my knowledge and belief, that each of the cattle described below, now about to be put on board the said vessel, has been

bred and fed exclusively in Denmark, Schleswig, and Holstein, or some or one of them, and has never been in contact with cattle not so exclusively bred and fed.

Dated this day of

[To be signed] *A.B.*

Description of cattle above referred to.

Number.*

Bulls _____

Oxen _____

Cows _____

Calves _____

* Number to be expressed both in words and in figures.

CERTIFICATE BY CONSULAR OFFICER.

I, *C.D.*, Vice-consul [*or as the case may be*] of Her Britannic Majesty at the Port of Husum [*or as the case may be*], hereby certify that the foregoing declaration was made by the above-named *A.B.* before me, this day of , 1873, and that I know the said *A.B.*, and that he is worthy of belief.

[To be signed] *C.D.*

[and Consular Seal to be affixed.]

CERTIFICATE BY OFFICER OF ROYAL PRUSSIAN PROVINCIAL COUNCIL OFFICE.

I, *X.Y.*, hereby certify that I have this day seen the cattle above described, and that I believe the statement respecting the breeding and feeding of each of them contained in the foregoing declaration of *A.B.* to be true in all respects.

[To be signed] *X.Y.*,
Officer of Royal Prussian Provincial Council Office, at the Port of Husum [*or as the case may be*].)

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Special provisions respecting metropolis.

28. With respect to the metropolis, notwithstanding anything in this Act or in the Second Schedule thereto, the following provisions shall have effect :

(1.) The mayor, aldermen, and commons of the city of London shall, for the purposes of this part of this Act, be exclusively the local authority in and for the metropolis :

(2.) The mayor, aldermen, and commons, on exercising for the purposes of this part of this Act the borrowing powers vested in a local authority under this Act, may borrow on the credit of the property on the credit whereof they are authorised to borrow by the Metropolitan Market Act, 1865, and the money so borrowed may be secured in the manner and subject and according to the provisions in that Act authorized and contained :

(3.) All money received by the mayor, aldermen, and commons from charges made by them under this part of this Act shall (subject to the application thereof as in this part of this Act directed in payment of interest on and in repayment of principal of money borrowed for the purposes of this part of this Act) be applied in repayment of the principal of money borrowed by them

under The Metropolitan Market Acts, 1857 and 1865, and subject thereto in discharge of expenses incurred by them in the execution of this part of this Act :

(4.) From and after the opening for public use of a market provided by the mayor, aldermen, and commons under this part of this Act to the satisfaction of the Privy Council (declared by order), the maximum tolls, dues, and payments that may be taken under The Metropolitan Market Act, 1857, in respect of the animals mentioned in the fifth schedule to this Act, shall be the sums in that schedule specified in lieu of those specified in schedule A. to that Act.

Provision on failure of Corporation of London to provide market.

29. Provided that if the mayor, aldermen, and commons of the city of London do not before the first day of January, one thousand eight hundred and seventy-two, provide and open for public use a market for the purposes of this part of this Act to the satisfaction of the Privy Council (declared by order), then on and after that day the following consequences shall ensue :

(1.) The provision of this part of this Act making the mayor, aldermen, and commons exclusively for the purposes of this part of this Act the local authority in and for the metropolis shall cease to operate :

(2.) The enactment in section fifteen of The Metropolitan Market Act, 1857, that no new market for the sale of cattle or horses shall be opened in the cities of London or Westminster, or the liberties thereof, or in the borough of Southwark, or at any place distant less than seven miles in a straight line from St. Paul's Cathedral in the city of London, shall not prevent any local authority or person from establishing a market for the purposes of this part of this Act in or at any place named or defined in that section.

Continuance of defined part where market, &c., provided.

30. Where a local authority, with the approval of the Privy Council, have before or after the passing of this Act provided, erected, and fitted up within a part of a port defined by the Privy Council as a place where foreign animals may be landed any wharf, lair, shed, market, house, or place for the landing, reception, sale or slaughter of foreign animals, it shall not be lawful for the Privy Council (as long as importation of foreign animals at that port is allowed, but under restriction) to revoke the definition of the part or parts of that port at which foreign animals may be landed, or to alter it so as to exclude therefrom any part of the site of such wharf, lair, shed, market, house, or place, except with the consent of the local authority ; and if any railway company have provided, erected, or fitted up any such wharves, lairs, sheds, markets, houses, or places, the same may, with the approval of the Privy Council, be used for the purposes of this part of this Act.

(By an Order in Council (341) of December 20, 1871, the restrictions imposed by The Metropolitan Contagious Diseases (Animals) Order of August, 1869, were revoked after December 31st of that year.)

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Part IV.—Discovery and Prevention of Disease.

Inspector to proceed on information.

31. An inspector of a local authority, on receiving information of the supposed existence of cattle plague, pleuro-pneumonia, or sheep-pox, or having reasonable ground to suspect that any of those diseases exist in any place within his district, shall proceed to that place with all practical speed, and execute and discharge the powers and duties by or under this Act conferred and imposed on him as inspector.

Power of entry for inspector, &c.

32. An inspector or other officer of a local authority authorized to act in the execution of this Act may at any time enter any field, stable, cow-shed, or other premises within his district, where he has reasonable grounds for supposing that any animal affected with cattle plague, pleuro-pneumonia, or sheep-pox is to be found, for the purpose of executing this Act, but shall, if required, state in writing the grounds on which he has so entered.

If any person refuses admission to such inspector or officer acting under this section, he shall be deemed guilty of an offence against this Act.

Evidence of disease.

33. The certificate of an inspector of a local authority to the effect that an animal within his district is affected with cattle plague, pleuro-pneumonia, or sheep-pox, shall for the purposes of this Act be conclusive evidence in all courts of justice and elsewhere of the matter certified.

Infected Places: Cattle Plague and Sheep-pox.

Provisional declaration of infected place by inspector.

34. Where an inspector finds cattle plague or sheep-pox to exist within his district, he shall forthwith make a declaration thereof under his hand, and shall deliver a notice under his hand of such declaration to the occupier of the field, stable, cow-shed, or other premises where the disease is found, and thereupon the same, with all lands and buildings contiguous thereto in the same occupation, shall become and be an infected place, and the same shall continue to be an infected place until the determination and declaration of the local authority relative thereto in this Act provided for.

Determination and declaration of local authority.

35. Where an inspector makes such a declaration of the existence of cattle plague or sheep-pox, he shall with all practicable speed send a copy thereof to the Privy Council, and deliver the declaration to the local authority, who shall forthwith inquire into the correctness thereof, and if it appears to them that cattle plague or sheep-pox existed as declared by the inspector, they shall so determine and declare, and shall prescribe the limits of the infected place; but if it appears to them that cattle plague or sheep-pox did not exist as declared by the inspector, and the same is certified to them in writing by one or more duly qualified veterinary surgeon or surgeons, employed by them in that behalf, they shall so determine and declare, and thereupon the place comprised in the inspector's declaration, or affected thereby, shall cease to be an infected place.

Declaration of infected place by local authority or Privy Council.

36. A local authority with respect to any place within their district, and the Privy Council with respect to any place in Great Britain, may from time to time by order declare any field, stable, cow-shed, or other premises in which cattle plague or sheep-pox exists at the date of the order or has existed within seven days before that date, with or without a further area, to be from and after a time specified in the order an infected place.

37. The area of an infected place may in all cases of a declaration by a local authority include, with the field, stable, cowshed, or other premises in which cattle plague or sheep-pox has been found to exist, all lands and buildings lying contiguous thereto, being in the same occupation, and within the district of the local authority, and also (except in the metropolis) an area comprised within one mile from the boundaries of those lands in every direction, but no more. A.D. 1869, — Extent of area on declaration by local authority.

38. A local authority may include in the area of an infected place any adjoining part of the district of another local authority, with the previous consent of that authority in writing signed by their clerk, but not otherwise. Extension of area into district of other authority.

39. The area of an infected place may in all cases of a declaration by the Privy Council include, with the field, stable, cowshed, or other premises in which cattle plague or sheep-pox has been found to exist, such an area as to the Privy Council seems requisite. Extent of infected place under declaration by Council.

40. With respect to the metropolis the Privy Council may from time to time by order extend the limits of an infected place beyond the boundaries of the field, stable, cowshed, farm, or premises where cattle plague or sheep-pox is declared or found to exist. Area of infected places in metropolis.

41. The area of an infected place may in any case be described by reference to a map deposited at some specified place, or by reference to townships, parishes, farms, or otherwise. Description of infected place.

42. An order of a local authority declaring a place to be an infected place shall be published by the local authority by notices posted in and near the infected place, and in such other manner (if any) as they think expedient. Notice of declaration.

An order of the Privy Council declaring a place to be an infected place shall be published in like manner by and at the expense of any local authority to whom the same is sent by the Privy Council for publication.

Any want of or defect or irregularity in publication shall not invalidate any order.

43. An order of a local authority or of the Privy Council declaring a place to be an infected place shall be conclusive evidence in all courts of justice and elsewhere of the existence of disease and other matters on which the order proceeds. Order evidence of disease.

44. The rules set forth in the sixth schedule to this Act shall have effect with respect to infected places (which rules are in this Act referred to as the rules of this Act with respect to infected places). Rules in schedule.

45. If any animal, hide, skin, hair, wool, horn, hoof, offal, carcase, meat, dung, hay, straw, litter, or other thing is moved in contravention of the rules of this Act with respect to infected places, every person moving the same, or causing the same to be moved, shall be deemed guilty of an offence against this Act. Offences as to infected places.

46. The rules of this Act with respect to infected places shall not restrict the moving of any animal or thing by railway through an infected place, such animal or thing not being stopped within the infected place. Exception for railways.

47. The Privy Council may from time to time by order make rules with respect to infected places not being inconsistent with the rules set forth in the sixth schedule to this Act; and with respect to the metropolis, the Privy Council may also from time Power to Privy Council to make rules as to infected places.

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to time, if they think it expedient, vary the rules set forth in that schedule; and all rules and variations of rules so made shall be deemed rules of this Act with respect to infected places.

Duties of local authorities, &c.

48. Every local authority and the police of every county, borough, town, and place shall, within their respective districts, enforce and execute the provisions of this Act and of any order of the local authority or Privy Council thereunder relative to infected places, and do or cause to be done all things from time to time necessary or expedient for securing, as far as may be, the effectual isolation of infected places in respect of the movement of animals and things.

Authority of constable.

49. Any constable may proceed as follows:

(1.) He may apprehend any person found committing an offence against the rules of this Act with respect to infected places, and he shall take any person so apprehended, as soon as conveniently may be, before a justice of the peace to be examined and dealt with according to law; and a person so apprehended shall not be detained in custody by any constable without the order of a justice longer than is necessary for bringing him before a justice, or than twenty-four hours at longest:

(2.) He may require that any animal or thing moved out of an infected place in contravention of those rules be forthwith taken back within the limits of that place, and may enforce and execute such requisition.

Discontinuance of declaration of infected places.

50. The local authority by whom an infected place is declared may, at any time after the expiration of twenty-eight days from the disappearance of cattle plague or sheep-pox (as the case may be) in that place, by order declare the place to be free from cattle plague or sheep-pox (as the case may be).

The Privy Council may at any time by order declare any place to be free from cattle plague or sheep-pox.

Thereupon, as from the time specified in this behalf in the order of the local authority or Privy Council, the place shall cease to be an infected place as regards cattle plague or sheep-pox (as the case may be).

Report to Privy Council.

51. The clerk of a local authority declaring a place to be an infected place, or declaring a place to be free from cattle plague or sheep-pox, shall forthwith report by post to the Privy Council the fact of such declaration having been made.

Effect of orders of Council.

52. An order of the Privy Council relative to an infected place shall supersede any order of a local authority inconsistent with it.

Restriction on movement, &c., near infected places.

53. Where, under this Act, an inspector makes a declaration which constitutes a place an infected place, he may also, if the circumstances of the case appear to him so to require, deliver a notice under his hand of such declaration to the occupiers of all lands and buildings adjoining thereto, any part whereof respectively lies within one mile of the boundaries of the infected place in any direction, and thereupon the rules of this Act with respect to infected places shall, until the determination and declaration of the local authority relative thereto in this Act provided for, apply and have effect to and in respect of those lands and buildings as if the same were actually within the limits of the infected place.

Pleuro-pneumonia.

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Provisional declaration as to pleuro-pneumonia by inspector.

54. Where an inspector finds pleuro-pneumonia to exist within his district, he shall forthwith make a declaration thereof under his hand, and shall deliver a notice under his hand of such declaration to the occupier of the field, stable, cow-shed, or other premises where the disease is found; and thereupon the rules set forth in the seventh schedule to this Act (in this Act called the pleuro-pneumonia rules of this Act) shall have effect in relation to such field, stable, cow-shed, or other premises until the determination and declaration of the local authority relative thereto in this Act provided for.

Determination and declaration by local authority as to pleuro-pneumonia.

55. Where an inspector makes a declaration of the existence of pleuro-pneumonia, he shall with all practicable speed send a copy thereof to the Privy Council, and deliver the declaration to the local authority, who shall inquire into the correctness thereof; and if it appears to them that pleuro-pneumonia existed as declared by the inspector, they shall so determine and declare, and thereupon the pleuro-pneumonia rules of this Act shall continue to apply to the field, stable, cow-shed, or other premises to which the declaration relates; but if in any such case it appears to the local authority that pleuro-pneumonia did not exist as declared by the inspector, or that a fresh case of pleuro-pneumonia has not occurred for thirty days in such field, stable, cow-shed, or other premises, then the local authority shall so determine and declare, and the pleuro-pneumonia rules of this Act shall cease to operate in relation thereto.

Miscellaneous.

Forms in schedule.

56. The forms given in the eighth schedule to this Act, with such variations as circumstances require, may be used by an inspector for the purposes of this part of this Act, and a declaration of disease under this part of this Act shall not be deemed a certificate of the inspector for any purpose of this Act.

Exposure for sale, transport by railway, &c. of diseased animals.

57. If any person exposes in a market or fair or other public place where horses or animals are commonly exposed for sale, or exposes for sale in any sale-yard, whether public or private, or places in a lair or other place adjacent to or connected with a market or fair, or where horses or animals are commonly placed before exposure for sale, or sends or causes to be carried on a railway, or on a canal, river, or other inland navigation, or on a coasting vessel, or carries, leads, or drives, or causes to be carried, led, or driven on a highway or thoroughfare, any horse or animal affected with a contagious or infectious disease, he shall be deemed guilty of an offence against this Act, unless he shows to the satisfaction of the justices before whom he is charged that he did not know of the same being so affected, and that he could not with reasonable diligence have obtained such knowledge.

Where any horse or animal so affected is exposed or otherwise dealt with in contravention of this section, an inspector of the local authority or any officer of the local authority authorized to act in execution of this Act may seize the same, and cause it, if affected with glanders, cattle plague, or sheep-pox, to be slaughtered, and if affected with any other contagious or infectious disease to be removed to some convenient or isolated place, and to be there kept for such time as the local authority

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think expedient; and the local authority may recover the expenses of the execution by them of this section from the owner of the horse or animal, or from the consignor or consignee thereof, who may recover the same from the owner.

In case of a conviction for an offence under this section no compensation shall be payable in respect of any animal slaughtered under this section.

Notwithstanding anything in this section, the Privy Council may from time to time, by order, make such further or other provision as they think expedient respecting animals becoming affected with foot-and-mouth disease, or any other contagious or infectious disease not being cattle plague, pleuro-pneumonia, sheep-pox, or glanders, while exposed or placed or being carried, led, or driven as aforesaid, and any such order shall be deemed part of this section.

(*An Order of Council* (355), *dated August* 8, 1872, *refers to the cleansing and disinfection of markets, &c., in the following terms:*

1. This order may be cited as The Markets Order of 1872.
2. This order extends to Great Britain only.
3. Words in this order have the same meaning as in the Act of 1869.
4. Every local authority is hereby empowered to make from time to time, with the view of preventing the spreading of contagious or infectious disease among animals, regulations for the following purposes, or any of them:—

(1.) For requiring the owners, lessees, or occupiers of places used for the holding of markets, fairs, exhibitions, or sales of animals, or for the lairage of animals, to cleanse those places from time to time at their own expense:

(2.) For requiring the owners, lessees, or occupiers of those places to disinfect the same, or any specified part thereof, from time to time at their own expense, where, in the judgment of the local authority, the circumstances are such as to allow of such disinfection being reasonably required:

(3.) For prescribing the mode in which such cleansing and such disinfection shall be effected.

5. Notwithstanding anything in The Animals Order of 1871, article 39 of that order shall not apply to the cleansing and disinfecting of any such place as aforesaid.

6. If the owner, lessee, or occupier of any such place as aforesaid does any act in contravention of the regulations of a local authority under this order, or fails in respect to observe the same, it shall not be lawful for him or any other person at any time thereafter, until further order of the Privy Council, to hold a market, fair, exhibition or sale of animals in that place, and the holding therein of any market, fair, exhibition, or sale of animals shall be and the same is hereby prohibited accordingly, and if any person holds any market, fair, exhibition, or sale of animals in contravention of this order, he shall be deemed guilty of an offence against this order.)

Turning out of diseased animals on uninclosed lands, &c.

58. If any person places or keeps on any common or uninclosed land or in any field or other place insufficiently fenced, or on the side of a highway, any horse or animal affected with a contagious or infectious disease, he shall be deemed guilty of an

offence against this Act, unless he shows to the satisfaction of the justices before whom he is charged that he did not know of the same being so affected, and that he could not with reasonable diligence have obtained such knowledge. A.D. 1869.

Trespass on land.

59. Where a person having cattle in his possession or keeping within the district of a local authority wherein cattle plague exists affixes at the entrance to a building or inclosed place in or on which such cattle are kept a notice forbidding persons to enter into or on that building or place without his permission, then, if any person not having a right of entry or way into, on, or over that building or place, enters into, on, or over the same or any part thereof, in contravention of the notice he shall for every such offence be liable to a penalty not exceeding five pounds.

Burial of diseased animals.

60. Every local authority shall cause every horse or animal that has died of glanders, cattle plague, or sheep-pox, or has been slaughtered in consequence of being affected with glanders, cattle plague, or sheep-pox, within their district, to be buried as soon as possible in its skin in some proper place, and to be covered with a sufficient quantity of quicklime or other disinfectant, and with not less than six feet of earth, or to be destroyed under inspection of the local authority in such mode as the Privy Council may from time to time by order direct or approve..

It shall not be lawful for any person, except with the licence of the Privy Council, to dig up or cause to be dug up the carcase or any part of the carcase of any horse or animal so buried.

(*An Order of Council* (341), *dated December* 20, 1871, *thus amends and renews the regulations relating to contagious or infectious disease among animals:*

Discovery and Prevention of Disease.

19. Every person having in his possession or under his charge an animal (including a horse) affected with a contagious or infectious disease, shall observe the following rules:—

(1.) He shall, as far as practicable, keep such animal separate from animals not so affected.

(2.) He shall with all practicable speed give notice to a police constable of the fact of the animal being so affected.

Such police constable shall forthwith give notice thereof to the inspector of the local authority, who shall forthwith report the same to the local authority and (except in the case of foot-and-mouth disease) to the Privy Council.

20. Where an inspector finds in his district cattle plague, pleuro-pneumonia, sheep-pox, sheep-scab, or glanders, he shall forthwith make a return thereof to the local authority and to the Privy Council, on a form provided by the Privy Council, with all particulars therein required, and shall continue to make a similar return on the Saturday of every week until the disease has disappeared.

21. Any dung of animals, and any hay, straw, litter, or other thing, commonly used for food of animals or otherwise for or about animals, may be moved out of an infected place within the metropolis (but not out of the metropolis) with a licence signed by an officer of the local authority appointed in that behalf certifying that the thing moved has been disinfected, but not otherwise.

22. Any officer authorized in this behalf by a local authority, or any constable or police officer, may stop and detain any animal (including a horse) which is being moved, or which he has reasonable grounds for suspecting is being moved, in contravention of the Act of 1869 or any Order of Council, and may apprehend, without warrant, the person in charge thereof, and bring him before a justice, who shall inquire into the case in a summary manner, and may, if satisfied that there are good grounds for so suspecting, by writing under his hand direct the animal to be detained, and the person in charge thereof to be brought before two justices as soon as practicable.

On such person being brought before two justices they shall adjudicate on the case in a summary manner, and if satisfied that the animal was being moved in contravention as aforesaid may direct it to be disposed of in conformity with the provisions of the Act of 1869 or any Order of Council.

23. Any officer authorized in this behalf by a local authority, or any constable or police officer, may inspect any railway truck, cart, boat, or other vehicle used by land or by water, in which animals (including horses, hay, manure, litter, straw, and other articles used for or about animals are usually or at the time of such inspection carried, and may examine the person in charge thereof with a view to ascertain whether any animals or articles are being moved or carried in contravention of the Act of 1869 or any Order of Council; and such officer may, if he has reasonable grounds for suspecting that such animals or articles are being moved or carried in contravention as aforesaid, apprehend, without warrant, the person in charge thereof, and bring him before a justice, who shall inquire into the case in a summary manner, and may, if satisfied that there are good grounds for so suspecting, by writing under his hand direct the same to be detained, and the person in charge thereof to be brought before two justices as soon as practicable.

On such person being brought before two justices they shall adjudicate on the case in a summary manner, and if satisfied that the animals or articles were being moved or carried in contravention as aforesaid may direct the same to be destroyed or otherwise disposed of in conformity with the provisions of the Act of 1869 or any Order of Council.

24. Any person having charge of any animal (including a horse) or thing that is being moved on a highway, railway, canal, navigation, or river, for the moving whereof a licence is requisite, shall, on being so required by an officer of a local authority authorized in this behalf or by a constable or police officer, produce the licence (if any) for the moving of that animal or thing.

25. A constable or police or other officer, detaining any animal (including a horse) under the Act of 1869 or any Order of Council shall cause it to be supplied with requisite food and water during its detention; and any expenses incurred by him in respect thereof may be recovered from the person in charge of the animal or from its owner.

26. Any inspector or other officer empowered to carry the Act of 1869 or any Order of Council into effect may, if authorized in this behalf by general or special order in writing of the local authority, enter, for the purpose of carrying into effect the provisions of such Act or Order, any field, stable, cowshed, or other premises within his district, where he has reasonable grounds for supposing that any animal affected with cattle plague or sheep-pox has been, or has been buried or otherwise disposed of.

If any person refuses admission to, or obstructs or impedes, or aids in obstructing or impeding, such inspector or other officer, he shall be deemed guilty of an offence against this order.

27. A local authority may, from time to time, with the view of preventing the spreading of contagious or infectious disease, make regulations for the following purposes, or any of them:

For prohibiting or regulating the movement of animals (including horses) on to, from, and through, and the keeping thereof on, commons and wastes and commonable and other lands whereon there exists a right of common or other right in the nature thereof.

For preventing any person from driving animals (including horses) under his charge, or allowing them to be driven or to stray, into an inclosed field or place without the consent of the occupier thereof.

For preventing the spreading by means of dogs of any such disease.

For prohibiting or regulating the removal of hay, straw, litter, or other thing commonly used for food of animals, or otherwise for or about animals, that has been in the same field, stable, cowshed, or other premises with animals affected with any contagious or infectious disease, or any dung that has been therein.

For providing for the cleansing and disinfection of sheds and places used by animals affected with any contagious or infectious disease.

Foot-and-Mouth Disease.

28. A local authority may, from time to time, with the view of preventing the spreading of foot-and-mouth disease, make regulations for the following purposes, or any of them :—

For prohibiting or regulating the movement out of any field, stable, cowshed, or other premises in which foot-and-mouth disease has been found to exist, of any animal that has been in the same field, stable, cowshed, or other premises with or in contact with any animal affected with foot-and-mouth disease.

Sheep Scab.

29. A local authority may, from time to time, with the view of preventing the spreading of sheep-scab, make regulations for the following purposes, or any of them :—

For prohibiting any person from having in his possession or under his charge a sheep affected with sheep-scab, without treating that sheep or causing it to be treated, with some dressing or dipping or other remedy for sheep-scab.

For prohibiting or regulating the movement out of any field, stable, cowshed, or other premises in which sheep-scab has been found to exist, of any sheep that has been in contact with, or in the same field, stable, cowshed, or other premises with any sheep affected with sheep-scab.

Pleuro-pneumonia.

30. A local authority may, from time to time, with the view of preventing the spreading of pleuro-pneumonia, make regulations for the following purposes, or any of them :—

For prohibiting or regulating the removal out of any field, stable, cowshed, or other premises, of the carcases of any cattle which have died or have been slaughtered in consequence of being affected with pleuro-pneumonia.

Provided that such local authority shall, from time to time, define the area within their district within which any such regulation shall have effect.

31. Where a local authority is authorized by the Privy Council to slaughter cattle affected with pleuro-pneumonia, such local authority may

cause all cattle affected with pleuro-pneumonia within their district to be slaughtered, subject to the following provisions:—

(1.) The local authority shall, by way of compensation for every such animal, pay to the owner thereof such sum, not exceeding twenty pounds and not exceeding one half of the value of the animal immediately before it was affected with pleuro-pneumonia, as to the local authority seem fit.

(2.) They may require the value of any such animal to be ascertained by their officers, or by arbitration, and generally they may impose conditions as to evidence of the slaughter and value of any such animal.

(3.) They may, if they think fit, withhold compensation in respect of any such animal, where the owner or the person having the charge thereof has in their judgment been guilty, in relation to such animal, of any act in contravention of the Act of 1869 or of any order or regulation or licence of the Privy Council or of a local authority, or has, in relation to such animal, failed to comply with the provisions of the Act of 1869, or of any such order, regulation, or licence, in respect of the giving of notice of disease, or in any other respect.

32. The expenditure of a local authority in pursuance of this order in respect of compensation for cattle slaughtered as being affected with pleuro-pneumonia, shall be defrayed out of the local rate.

33. Where the local authority in pursuance of this order cause any animal to be slaughtered as affected with pleuro-pneumonia, the owner thereof shall not be entitled to recover in respect of the insurance thereof any sum which, together with the payment which he receives for the same under this order, would exceed the sum which he would have been entitled to receive in respect of the insurance.

34. Every local authority shall keep, in such manner and form as the Privy Council from time to time direct or approve, a record, stating the date of any order made by them for slaughter under this order, and the execution of the order, and other proper particulars; and such record shall be evidence if any question arises concerning an order for the slaughter of any such animal, or concerning compensation in respect thereof.

35. Where a local authority is authorized by the Privy Council to put in operation this provision of this order, such local authority may, from time to time, with the view of preventing the spreading of pleuro-pneumonia, prohibit or regulate the holding of any specified market, fair, auction, sale, or exhibition, of cattle within their district.

An Order of Council (366), *dated August* 2, 1873, *is important with regard to contagious Pleuro-pneumonia and Foot-and-Mouth disease. It is as follows:—*

1. This order may be cited as The Animals (Amendment) Order of 1873.

2. This order shall take effect from and immediately after the thirty-first day of August, one thousand eight hundred and seventy-three; and words in this order have the same meaning as in the Act of 1869.

Pleuro-pneumonia.

3. Every local authority shall cause all cattle affected with pleuro-pneumonia within their district to be slaughtered.

The provisions numbered (1), (2), and (3) of article 31, and articles 32,

33, and 34, relating to compensation, of The Animals Order of 1871, shall have effect in case of slaughter under this article of this Order.

Foot-and-Mouth Disease.

4. Foot-and-mouth disease shall not be deemed to be a contagious or infectious disease within either of the following articles of The Animals Order of 1871, namely,—articles 19 and 27.

Any regulations made by a local authority under the said article 27, as far as they relate to foot-and-mouth disease, are hereby revoked.

5. Where an animal becomes affected with foot-and-mouth disease while exposed or placed or being carried, led, or driven, as in section fifty-seven of the Act of 1869 mentioned, it may, notwithstanding anything in that section, be, with a licence of an inspector of the local authority authorized to issue the same, but not otherwise, moved for purposes of feeding, or watering, or other ordinary purposes connected with the breeding or rearing of animals, to any land or building in the occupation of the owner of the animal, or for slaughter to the nearest slaughter-house or some other slaughter-house approved by the local authority.

The form given in the second schedule to this Order, or a form to the like effect, with such variations as circumstances require, shall be used.

Revocation.

6. The orders and part of an Order of Council described in the first schedule to this Order, and any regulations made by a local authority under that part of an order, are hereby revoked: Provided that nothing in this Order shall invalidate or make unlawful anything done under the said orders and part of an order and regulations, or interfere with the institution or prosecution of any proceeding in respect of any offence committed against or any penalty or forfeiture incurred under the same.

An Order in Council, issued in June, 1874, revokes Article 5 of the above,—consequently Articles 19, 27, and 28 of The Animals (Amendment) Order of 1873 are restored.

Burial and Disinfection.

36. Where, under section sixty of the Act of 1869, a horse or animal is buried, its skin shall be first so slashed as to prevent its being of any use. The local authority may, if they think fit, use for the purpose of such burial any place on the premises of the owner of the horse or animal.

37. Where a local authority is authorized by licence from the Privy Council to destroy, under section sixty of the Act of 1869, horses or animals that have died or been slaughtered as therein mentioned, every such horse or animal shall be destroyed in manner following, namely, the carcase thereof shall be disinfected, and shall then be removed, in charge of an officer of the local authority, to a horse slaughterer's or knacker's yard licensed for the purpose by the Privy Council, or other place so licensed, and shall be there destroyed by exposure to a high temperature, or by chemical agents. In every such case the local authority shall report to the Privy Council the fact and mode of destruction.

38. Where a local authority exercise the power of causing premises to be cleansed and disinfected, conferred on them by the Act of 1869 or by any Order of Council, the occupier of those premises shall give all facilities for that purpose.

39. Where any landing-place, lair, shed, or other place is directed by the Act of 1869 or any Order of Council, or is ordered by a local authority, to be cleansed and disinfected, it shall be cleansed and disinfected in manner following:—

(1.) By the sweeping out thereof and the effectual removal therefrom of all dung, sawdust, litter, and other matter:
(2.) Then by the thorough washing therewith with water:
(3.) Then by the application to the floor and to all parts above the floor with which animals or their droppings have come in contact, of a coating of limewash made by mixing good freshly-burnt lime with water, and containing in each gallon of limewash either one-fifth of a pint of commercial carbolic acid, or one-fifth of a pint of commercial cresylic acid, or four ounces of fresh dry chloride of lime, such limewash to be prepared immediately before use.

The sweepings of the landing-place, lair, shed, or other place shall be well mixed with quicklime, and effectually removed from contact with animals.

General Provisions.

40. A local authority may from time to time revoke or alter any order, prohibition, or regulation made by them under the Act of 1869 or any Order of Council.

41. Every local authority shall send to the Privy Council a copy of every order, prohibition, or regulation made by them.

42. If the Privy Council are satisfied on inquiry, with respect to any prohibition or regulation made by a local authority under the Act of 1869 or any Order of Council that the same is of too restrictive a character, or otherwise objectionable, and direct the revocation thereof, the same shall thereupon cease to operate.

43. Whenever there is any change in the name or address of any inspector appointed under section twelve of the Act of 1869, or in the district of any such inspector, the local authority shall forthwith report the same to the Privy Council.

44. Except where otherwise provided for in any Order of Council, a local authority shall provide and supply, without charge, printed copies of documents or forms requisite under the Act of 1869 or any Order of Council.

45. Every regulation made by a local authority under any Order of Council shall (where no other provision is made for the publication thereof) be published by advertisement in a newspaper circulating in the district of the local authority.

46. If any person fails to give, produce, do, or observe any notice, licence, thing, or rule, which he is by this order or by any order or regulation of a local authority thereunder required to give, produce, do, or observe, he shall in every such case be deemed guilty of an offence against this Order.

47. If any animal (including a horse) or anything is moved or dealt with in contravention of this order or of any Order or regulation of a local authority thereunder, the owner thereof and the person directing or permitting such movement thereof or dealing therewith, and the person or company in charge of or removing or conveying the same, shall each be deemed guilty of an offence against this order.

48. All orders and regulations made by a local authority under any former Order of Council and in force at the commencement of this Order shall, as far as the same are not varied by or inconsistent with this Order, remain in force until altered or revoked by the local authority.)

61. A local authority shall cause the yard, shed, stable, field, or other premises in which any horse or animal affected with glanders or cattle plague or sheep-pox has been kept while so affected, or has died or been slaughtered, to be thoroughly cleansed and disinfected, and all hay, straw, litter, dung, or other article that has been in contact with or used about any such horse or animal to be burnt or otherwise destroyed.

Purification of sheds, &c. of diseased animals.

No fresh animal shall be admitted into any yard, shed, stable, field, or other premises in which any animal affected with cattle plague or sheep-pox has been kept while so affected, or has died or been slaughtered, until the expiration of thirty days after the cleansing and disinfecting of such premises in pursuance of this Act.

Any such hay, straw, litter, dung, or other article shall not be removed from the premises in which any horse or animal affected with glanders or cattle plague has been, except for the purpose of being destroyed and with the licence of an inspector specifying the place at which it is to be destroyed, nor shall it be removed out of the district of the local authority without the consent in writing of the local authority into whose district it is moved. If any such thing is removed in contravention of this Act, the occupier of the premises from which it is removed and the person removing it shall each be deemed guilty of an offence against this Act.

A local authority shall direct the disinfecting of the clothes of and the use of due precautions against the spreading of contagion by inspectors and others in contact with animals affected with cattle plague.

62. Every steamboat, railway, and other public company, and every person carrying animals for hire to or in Great Britain, shall thoroughly cleanse and disinfect, in such manner as the Privy Council from time to time by order direct, all steamers, vessels, boats, pens, carriages, trucks, horse-boxes, and vehicles used by such company or person for the carrying of animals.

Steamboat and railway companies, &c., to disinfect carriages, boats, &c.

If any company or person on any occasion fails to comply with the requisitions of any such order, such company or person shall on every such occasion be deemed guilty of an offence against this Act.

An inspector of a local authority or any officer of a local authority authorized to execute this Act, may at all times enter on board any steamer, vessel, or boat in respect whereof he has reasonable grounds for supposing that any company or person has failed to comply with the requisitions of any such order, and on premises where he has reasonable grounds for supposing that any pen, carriage, truck, horse-box, or vehicle in respect whereof any company or person has on any occasion so failed is to be found; and if any company or person refuses admission to an inspector or other officer acting under this section, such company or person shall be deemed guilty of an offence against this Act.

63. The Privy Council may from time to time by order give directions respecting modes of disinfecting, and anything disinfected in accordance with the provisions of such order, or in accordance with any process of disinfection approved by the Privy Council, shall be deemed disinfected within this Act, but not otherwise.

Regulations for disinfecting.

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Water and food to be provided at railways to satisfaction of Privy Council.

64. Every railway company shall make a provision, to the satisfaction of the Privy Council, of water and food, or either of them, at such stations as the Privy Council from time to time, by general or specific description, direct for animals carried or about to be or having been carried on the railway of the company; and such water and food, or either of them, shall be supplied to any such animal by the company carrying it on the request in writing of the consignor thereof, or on the request of any person in charge thereof, and the company so supplying water and food, or either of them, may make in respect thereof such reasonable charges, if any, as the Privy Council by order approve, in addition to such charges as they are for the time being authorized to make in respect of the carriage of animals; and the amount of such additional charges accrued due in respect of any animal shall be a debt from the consignor and from the consignee thereof to the company, and shall be recoverable by the company from either of them by proceedings in any court of competent jurisdiction, and the company shall have a lien for the amount thereof on the animal in respect of which the same accrued due, and on any other animal at any time consigned by the same person to be carried by the company.

If any company on any occasion fails to comply with the requirements of this section, they shall, on every such occasion, be deemed guilty of an offence against this Act. If in the case of any animal such a request as aforesaid is not made so that the animal remains without a supply of water for thirty consecutive hours, or other period not being less than twelve hours as the Privy Council from time to time by order prescribe, the consignor and the person in charge of the animal shall each be deemed guilty of an offence against this Act; and it shall lie on the person accused to prove the time within which the animal has had a supply of water.

(*By an Order of Council* (341), *dated December* 20, 1871, *the following renewed and amended regulations with regard to transit are made*:—

Transit of Animals by Sea.

5. In this part of this Order the term "animals" extends to all ruminating animals and to horses.

6. With respect to places used for animals on board vessels, the following regulations shall have effect:—

(1.) Every such place shall be divided into pens by substantial divisions.

(2.) Each pen shall not exceed nine feet in breadth, or fifteen feet in length.

(3.) The floor of each pen shall have proper battens or other footholds thereon.

(4) Every such place, if enclosed, shall be ventilated by means of separate inlet and outlet openings, of such size and position as will secure a proper supply of air to the place in all states of weather.

7. Between each first day of November and the next following thirtieth day of April, (both days inclusive,) freshly shorn sheep shall not be carried on the deck of a vessel.

8. When sheep are carried on the deck of a vessel, proper gangways shall be provided either between or above the pens in which the sheep are carried.

9. Animals landed from a vessel shall, on a certificate of an inspector appointed by the Privy Council in that behalf, certifying to the effect that the foregoing regulations, or some or one of them, have not or has not been observed in the vessel, be detained, at the landing-place, or in lairs adjacent thereto, until the Privy Council otherwise direct.

Cleansing and Disinfection of Vessels.

10. Every vessel used for carrying animals shall, after the close of each voyage, and before any fresh cargo is put on board, be cleansed and disinfected in manner following:—

(1.) By the sweeping out of the hold and every other part of the vessel used for animals, and the effectual removal therefrom of all dung and litter, and of all ashes, sand, sawdust, and other matter with which animals or their droppings have come in contact:

(2.) Then by the thorough washing of the same parts of the vessel with water:

(3.) Then by the application to the sides, floor, and ceiling of the hold and to every other part of the vessel with which animals or their droppings have come in contact, of a coating of limewash made by mixing good freshly burnt lime with water, and containing in each gallon of limewash either one-fifth of a pint of commercial carbolic acid, or one-fifth of a pint of commercial cresylic acid, or four ounces of fresh dry chloride of lime, such limewash to be prepared immediately before use.

The sweepings of the vessel shall be well mixed with quicklime, and effectually removed from contact with animals.

Shipping and Unshipping Places.

11. At every place where animals are put on board of or landed from vessels, provision shall be made, to the satisfaction of the Privy Council, for a supply of water for animals; and water shall be supplied there, gratuitously, on request of any person in charge of any animals.

12. At every place where animals are landed from vessels, provision shall be made, to the satisfaction of the Privy Council, for the speedy and convenient unshipment of animals, and for a supply of food for them; and food shall be supplied there, on request of any person in charge of any animals, at such price as the Privy Council, from time to time, approve.

Cleansing and Disinfection of Landing Places.

13. Where any animal affected with any contagious or infectious disease is landed at a port, or is, while so affected, in or at any landing-place or lair, or other place adjacent thereto, then the landing-place and every such lair or other place where the animal has been shall not be used for any animals not forming part of the same cargo unless and until it has been cleansed and disinfected.

Transit of Animals by Railway.

14. Every truck used for carrying animals on a railway shall be provided with spring buffers, and the floor thereof shall have proper battens or other foothold thereon.

15. A railway company shall not allow any truck used for carrying animals on their railway to be overcrowded so as to cause unnecessary suffering to the animals therein.

16. Between each first day of November and the next following thirtieth

day of April, (both days inclusive,) trucks used for carrying on a railway sheep freshly shorn and unclothed shall be covered and inclosed so as to protect the sheep from the weather, but shall be properly ventilated.

Cleansing and Disinfection of Pens and Vehicles.

17. Every pen, carriage, truck, horse-box, or vehicle used for carrying animals on land, shall on every occasion after any animal is taken out of the same, and before any other animal is placed therein, be cleansed and disinfected in manner following:—

(1.) By the sweeping out of the pen, carriage, truck, horse-box, or vehicle, and the effectual removal therefrom of all dung, sawdust, litter, and other matter:

(2.) Then by the thorough washing of the pen, carriage, truck, horse-box, or vehicle with water:

(3.) Then in case of a pen, carriage, or truck, by the application to the floor and to all parts above the floor with which animals or their droppings have come in contact, of a coating of limewash made by mixing good freshly burnt lime with water, and containing in each gallon of limewash either one-fifth of a pint of commercial carbolic acid, or one-fifth of a pint of commercial cresylic acid, or four ounces of fresh dry chloride of lime, such limewash to be prepared immediately before use.

The sweepings of the pen, carriage, truck, horse-box, or vehicle shall be well mixed with quicklime and effectually removed from contact with animals.

Penalties.

18. If anything is done or omitted to be done in contravention of any of the regulations of this part of this order, the owner, and the master or person having charge or command of the vessel in which,—and the owner and the occupier of the place where animals are put on board of or landed from vessels at which,—and the company carrying animals on or owning or working a railway on which,—and also in case of the overcrowding of a truck on a railway, or of the carrying on a railway of sheep freshly shorn and unclothed, the consignor of the animals in respect of which,—(as the case may be,) such thing is done or omitted, shall severally be deemed guilty of an offence against this order.

Provided, that no person shall be liable to a penalty under this part of this order in respect of sheep as freshly shorn, where it is proved that the sheep have not been shorn within sixty days before the time of the commission of the alleged offence.

By an Order in Council (349), *dated July* 11, 1872, *the following regulation was to take effect from July* 3 (1) *of that year:—*

2. This Order may be cited as The Carcases of Animals Order of 1872.
3. In this Order—
   The Act of 1869 means The Contagious Diseases (Animals) Act, 1869:
   Master includes any person having the charge or command of a vessel:
   Other terms have the same meaning as in the Act of 1869.
4. In addition to the powers and duties vested in and imposed on local

authorities by section sixty of the Act of 1869, and by articles 36 and 37 of The Animals Order of 1871, every local authority is hereby empowered to make, from time to time, with the view of preventing the spreading of contagious or infectious diseases among animals, regulations for the following purpose:—

For securing the burial, in accordance with the directions of article 36 of The Animals Order of 1871, of the carcases, being within the district of the local authority, of animals (including horses) which have died of any contagious or infectious disease, or the destruction thereof, under inspection of the local authority, in the mode prescribed by article 37 of The Animals Order of 1871.

5. If an animal (including a horse) on board a vessel in Great Britain, or within three miles of the shore thereof, dies of or is slaughtered in consequence of being affected with a contagious or infectious disease, the master of the vessel shall, with all practicable speed, cause the carcase thereof to be disinfected on board the vessel in such mode as the Privy Council from time to time direct or approve.

If he fails to do so, he shall be deemed guilty of an offence against this order.

6. If any person throws or places, or causes or suffers to be thrown or placed, into or in any river, stream, canal, or other water in Great Britain, or into or in the sea within three miles of the shore of Great Britain, the carcase of an animal (including a horse) which has died of or been slaughtered in consequence of being affected with a contagious or infectious disease, he shall be deemed guilty of an offence against this order, unless he shows to the satisfaction of the justices before whom he is charged that he did not know that the same had so died or been slaughtered, and that he could not with reasonable diligence have obtained that knowledge.

7. It shall not be lawful for any person, except with the licence of the Privy Council, to dig up, or cause to be dug up, the carcase or any part of the carcase of any animal (including a horse) buried under a regulation of a local authority or under the direction of a receiver of wreck.

If any person acts in contravention of this article he shall be deemed guilty of an offence against this Order.)

PART V.—SLAUGHTER IN CATTLE PLAGUE: COMPENSATION. A.D. 1869.

Slaughter in cattle plague.

65. Every local authority shall cause all animals affected with cattle plague within their district to be slaughtered.

Slaughter of cattle herded with diseased animals.

66. A local authority may, if they think fit, cause to be slaughtered any animal that has been in the same shed or stable, or in the same herd or flock, or in contact with any animal affected with cattle plague within their district.

Slaughter of animals to ascertain disease.

67. Where an animal is affected with disease suspected to be cattle plague, the local authority may cause the animal to be slaughtered in order to ascertain the nature of the disease.

Compensation to owners of animals on slaughter.

68. Where an animal affected with cattle plague, or affected with disease suspected to be cattle plague, is slaughtered in pursuance of this Act, the local authority (except as otherwise provided in this Act) shall, by way of compensation for the animal, pay to the owner thereof such sum, not exceeding twenty pounds and not exceeding one half of the value of the animal immediately before it was affected with cattle plague, as to the local authority seems fit.

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Compensation for slaughter of cattle herded with diseased animals.

69. Where a local authority causes an animal to be slaughtered on account of it having been in the same shed or stable, or in the same herd or flock, or in contact with an animal affected with cattle plague, the owner of the animal so slaughtered may either dispose of the carcase on his own account, with a licence from some officer appointed in that behalf by the local authority, or may require the local authority to dispose of the same, in which latter case the local authority shall pay to the owner thereof, by way of compensation, such sum, not exceeding thirty pounds, as may equal three-fourths of the value of the animal slaughtered.

Power to ascertain value of slaughtered animals.

70. A local authority may require the value of any animal slaughtered under this Act to be ascertained by officers of the local authority or by arbitration, and generally may impose conditions as to evidence of the slaughter and value of the animals slaughtered.

Restrictions on compensation.

71. A local authority may, if they think fit, withhold compensation in respect to any animal slaughtered, where the owner or the person having the charge thereof has in their judgment been guilty, in relation to such animal, of any act in contravention of this Act, or of any order, regulation, or licence of the Privy Council or a local authority, or has, in relation to such animal, failed to comply with the provisions of this Act, or of any such order, regulation, or licence in respect of the giving of notice of disease or in any other respect, and may, if they think fit, withhold compensation in respect of a foreign animal slaughtered on account of it being affected with cattle plague, or with disease suspected to be cattle plague, if it appears to them that the animal was so affected at the time of the landing thereof.

Amount of insurance to be recovered.

72. Where an animal has been slaughtered in pursuance of this Act, the owner thereof shall not be entitled to recover in respect of the insurance thereof any sum which, together with the payment which he receives for the same under this Act, would exceed the sum which he would have been entitled to receive in respect of the insurance.

Reservation for experimental treatment.

73. The Privy Council may, notwithstanding anything in this Act, reserve for experimental treatment any animal ordered to slaughtered under this Act, but compensation shall be payable in respect thereof as if this section had not been enacted.

Record respecting slaughter.

74. Every local authority shall keep, in such manner and form as the Privy Council from time to time by order direct or approve, a record relative to proceedings under this part of this Act, stating the date of any order for slaughter, and the execution of the order, or the reservation of the animal for experimental treatment (as the case may be), and other proper particulars; and such record shall be evidence if any question arises concerning an order for the slaughter of any animal, or concerning compensation in respect thereof.

Part VI.—Orders of Council and Local Authorities.

Power to Privy Council to make orders.

75. The Privy Council may from time to time make such orders as they think expedient for all or any of the following purposes:

For insuring for animals brought by sea to ports in Great

Britain a proper supply of food and water during the passage and on landing :

For protecting such animals from unnecessary suffering during the passage and on landing :

For protecting animals from unnecessary suffering during inland transit :

For prohibiting or regulating the movement of animals, and the removal of dead animals or parts thereof, and of hay, straw, litter, dung, and other things likely to spread contagious or infectious diseases among animals :

For requiring the cleansing and disinfecting of yards, sheds, stables, fields, and other premises :

For regulating the disposal of animals dying while affected with a contagious or infectious disease :

For requiring notice of the appearance of any such disease among animals :

For prohibiting or regulating the holding markets, fairs, exhibitions, or sales of animals :

And generally any orders whatsoever which they think it expedient to make for the better execution of this Act, or for the purpose of in any manner preventing the introduction or spreading of contagious or infectious disease among animals in Great Britain (whether any such orders are of the same kind as the kinds enumerated in this section or not), and may in any such order direct or authorize the slaughtering of animals that are affected with any contagious or infectious disease, or that have been in contact with animals so affected ; and may in any such order direct or authorize the local authority to pay compensation for any animals so slaughtered ; and may in any such order impose penalties for offences against the same, not exceeding the sum of twenty pounds for any such offence, and so that in every such order provision be made that a penalty less than the maximum may be ordered to be paid ; and this section shall extend to horses and all ruminating animals not within the definition of animals in this Act.

Every such order shall have the like force and effect as if it had been enacted by this Act.

Privy Council Inspectors.

76. A person for the time being appointed by the Privy Council an inspector for the purposes of this Act shall have for and throughout Great Britian all such powers, authorities, and privileges as an inspector of a local authority has within or in relation to his district, and a direction of the Privy Council shall in the case of an inspector appointed by them be deemed equivalent to a direction of a local authority in the case of an inspector appointed by them.

Provisions for towns, &c.

77. The Privy Council may from time to time, by order, declare that such of the provisions of this Act, and of any order of the Privy Council under it, as relate to the metropolis, or any of those provisions, shall also extend and apply to any town, city, parish, or place specified in the order, and the same shall extend to such town, city, parish, or place accordingly ; and the Privy Council may at any time revoke or from time to time vary any such order.

Regulation, &c., of landing of hay, &c.

78. The Privy Council may from time to time by order make such regulations as they think expedient for prohibiting or regulating the landing of any hay, straw, fodder, or other article

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brought from any place out of the United Kingdom, whereby it appears to the Privy Council contagion or infection may be conveyed to animals, or for causing the same to be destroyed if landed.

If any person lands or attempts to land any hay, straw, fodder, or other article in contravention of any such order, the same shall be forfeited in like manner as goods the importation whereof is prohibited by the Acts relating to the Customs are liable to be forfeited, and the person so offending shall be liable to such penalties as are imposed on persons importing or attempting to import goods the importation whereof is prohibited by the Acts relating to the Customs, without prejudice to any proceeding against him under this Act or any such order, but so that no person be punished twice for the same offence.

Directions of Council and local authority.

79. The Privy Council may require a local authority to carry into effect any order of the Privy Council under this Act, and may authorize a local authority to make any regulations for the purpose of preventing the spreading of contagious or infectious diseases among animals, subject to such conditions as the Privy Council impose, and the local authority may by any such regulation impose such penalties as the Privy Council are by this Act authorized to impose by order.

Expenses of execution of orders.

80. The expenses incurred by a local authority in executing any order of the Privy Council under this Act shall be defrayed by the local authority out of such local rates or funds as such order directs, and subject to or in the absence of any such direction shall be deemed expenses incurred by the local authority in pursuance of this Act.

Publication of orders, &c.

81. Every order of the Privy Council under this Act shall be published in the London Gazette, save that where an order of the Privy Council affects only a particular port, town, or place, or part thereof, specified in the order, or declares a place to be an infected place, or to be free from cattle plague or from sheep-pox, or is in the nature of a licence under an Order of Council, or of a revocation of such a licence, then the insertion in the London Gazette of a notice of the issuing thereof shall be for all purposes sufficient publication thereof.

Any order of the Privy Council under this Act shall be published, by and at the expense of any local authority to whom the same is sent by the Privy Council for publication, in some newspaper circulating in the district of the local authority, or in such other manner as the Privy Council direct.

Any order or regulation made by a local authority shall be published by them at their own expense in such manner as the Privy Council direct, and, subject to or in the absence of any such direction, in such manner as the local authority think sufficient and proper to ensure publicity.

Instrument may be in print, &c.

82. Any order, licence, regulation, or other instrument made under this Act, or under any order of the Privy Council thereunder, may be in writing or print, or partly in writing and partly in print.

Stamp duty and fees not to be paid.

83. No stamp duty shall be payable on, and no fee or other charge shall be demanded or made for, any appointment, certificate, declaration, or licence under this Act, or any order or regulation made thereunder.

Evidence of orders.

84. An order or regulation made or issued by a local authority under this Act, or under any order of the Privy Council, may be proved as follows:—

By the production of a copy of a newspaper containing a copy of such order or regulation; or

By the production of a printed copy of such order or regulation, purporting to be certified to be a true copy by the clerk of the peace where the authority are justices in general or quarter sessions assembled, or by the town clerk or other officer performing the duties of a town clerk in the case of an authority having a town clerk or other officer as aforesaid, or by such other officer as the Privy Council prescribe:

And any such order or regulation shall, until the contrary is proved, be deemed to have been duly made and issued at the time at which it bears date.

Recovery of penalties.

85. Penalties and forfeitures shall be recoverable and applicable under an order of the Privy Council, or an order or regulation of a local authority, as penalties and forfeitures under this Act are recoverable and applicable.

Part VII.—Lands.

Acquisition of land by local authority.

86. A local authority may purchase or take on lease or at a rent land for the purpose of burying therein animals dying of or slaughtered on account of any contagious or infectious disease, or for the purpose of providing wharves, lairs, sheds, markets, houses, and places for the landing, reception, sale, and slaughter of foreign animals, or for any other purpose of this Act, and may sell, exchange, or dispose of lands acquired by them under this Act, but not required to be retained for the purposes thereof, carrying the money produced thereby to the credit of the local rate.

Conveyances, &c., of land.

87. Land purchased or taken on lease or at a rent under this Act by a local authority, not being a body corporate, shall be assured or demised to the local authority and their successors, in trust for the purposes of this Act, and shall be accepted, taken, and held by them as a body corporate.

Purchase under provisional order.

88. The regulations contained in section seventy-five of The Local Government Act, 1858, shall be observed with respect to the purchase of land by a local authority for the purposes of this Act, and shall apply and have effect as if the local authority were a local board acting under the Local Government Act, and the purposes of this Act were purposes of that Act, save that the advertisements and notices requisite under that section may be published and served in any two consecutive months instead of only in the months therein specified, and that the local rate be substituted for the rates therein mentioned; and the powers conferred by this section may be exercised by a local authority with respect to land either within and without their district.

Part VIII.—Expenses of Local Authorities.

89. The expenditure of a local authority in compensation for animals slaughtered under Part V. of this Act, or in respect of

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principal of or interest on money borrowed in pursuance of this Act, shall be defrayed out of the local rate, or out of a separate rate to be levied in all respects as the local rate, and included under the term local rate.

Any person who is not the owner of the premises in respect of which he is rated under this section to the local rate may deduct from the growing rent due to the owner of such premises one half of the rate payable by him for the purposes of this section, and every owner shall allow such deduction accordingly.

The owner for the purposes of this section shall be the person for the time being entitled to receive the rack-rent of the premises in respect of which the rate is made on his own account, or who would be entitled to receive the same if such premises were let at a rack-rent, including under the term rack-rent any rent which is not less than two-thirds of the net annual value of the premises out of which the rent issues.

Every local authority shall have power, notwithstanding any limit in any Act of Parliament, to levy a local rate to the amount required for the purposes of this Act, but every rate or increase of rate levied under this section shall in all precepts for the levy thereof be described as a separate rate or separate item of rate, and when collected from the individual ratepayers shall be collected as a separate rate or specified as a separate item of rate.

Every order of a board of guardians for contribution of monies, out of which any such expenditure as in this section mentioned is payable, shall state the amount in the pound of contribution required for such expenditure; and the overseers, on the receipt given to any ratepayer for poor rate, shall specify the amount (if any) collected in respect of such expenditure.

General expenses.

90. Expenses incurred by a local authority in pursuance of this Act, other than their expenditure in compensation for animals slaughtered under Part V. of this Act, or in respect of principal of or interest on money borrowed in pursuance of this Act, shall be defrayed out of the local rate.

Remission of rate in certain cases.

91. Where before the twentieth day of February one thousand eight hundred and sixty-six any person suffered so great a loss of cattle by cattle plague as to entitle him, after the passing of this Act, in the opinion of the local authority, to a remission in whole or in part of the amount due from him in respect of the local rate, such remission may be granted by the local authority.

Application of balance unappropriated.

92. Where at the passing of this Act a local authority have in their hands an unappropriated balance of a local rate levied under any Act repealed by this Act, they may, if they think fit, apply any part of such balance in compensation for cattle slaughtered between the passing of "The Cattle Diseases Prevention Act, 1866," and the appointment of inspectors under that Act, by direction of a person whom the owner of such cattle had reasonable ground to believe to be the authorized inspector for the execution of the Act; or they may carry such balance or any part thereof to the credit of the ordinary account of the local rate, to be applied for any of the purposes for which the local rate when levied under any Act other than an Act repealed by this Act is applicable.

Variation of forms of precepts and orders.

93. All precepts, orders for contribution, and forms of poor rate shall, where necessary, be varied in such manner as may be required for carrying into effect this Act.

94. The treasurer of a local authority may, if directed by them, advance out of any monies for the time being in his hands any sum required for payment of expenses incurred by them in pursuance of this Act.

Advance of monies by treasurer of local authority.

95. Where the local rate is a county rate or borough rate, or any other such rate as is mentioned in the second schedule to this Act, all the provisions of the statutes applicable to the making, levying, and collecting of a county rate, borough rate, or such other rate shall apply, notwithstanding that the whole of such rate, or any part thereof, is applicable to the payment of the expenditure of a local authority in pursuance of this Act in compensation for animals slaughtered, or in respect of principal of or interest on money borrowed in pursuance of this Act.

Saving of statutes applicable to rates leviable for expenses.

96. An error in the statement of the amount of expenses in any precept, warrant, contribution, order, or receipt issued or given under this Act shall not invalidate such precept, warrant, contribution, order, or receipt; but any person aggrieved by the error may appeal to the justices in petty sessions, and the justices may rectify the error, and award to the appellant compensation for any loss he may have sustained thereby, the amount of such compensation to be paid to the appellant, and to be deemed expenses of the local authority under this Act.

Error in statement not to vitiate precept, &c.

97. Notwithstanding anything in this Act, the local authority of each borough situate within a county and assessed to the county rate thereof shall be recouped the proportionate amount contributed by the borough to the expenses incurred by the local authority of the county in pursuance of this Act (including expenditure in compensation for animals slaughtered, or in respect of principal of or interest on money borrowed in pursuance of this Act, so that the burden of those expenses shall be borne wholly by the county, and not as to any part thereof by any borough situate within the county.

Recouping of charges on boroughs out of county rates.

Borrowing.

98. Where the rate levied or required for the purposes of this Act exceeds or would exceed sixpence in the pound, a local authority may, for the purposes of defraying any costs, charges, and expenses under this Act, borrow at interest on the credit of the local rate any sums of money necessary for defraying such costs, charges, and expenses; and for the purpose of securing the repayment of any sums of money so borrowed, together with such interest as aforesaid, the local authority may mortgage the local rate for any period not exceeding seven years.

Mortgage of rates in certain cases.

Where the rate levied or required for the purposes of this Act exceeds or would exceed ninepence in the pound, the Commissioners of Her Majesty's Treasury may, on application from the local authority, extend the term to any term not exceeding fourteen years, and the local authority may mortgage the rate accordingly.

Provided that where the local authority borrow for any purpose of this Act on any security other than the local rate (whether together with the local rate, if any, or separately therefrom) the limitations in this section contained respecting the amount of rate and the term of years shall not operate.

The provisions of The Commissioners Clauses Act, 1847, with respect to the mortgages to be executed by the commissioners,

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shall be incorporated with this section, the local authority being deemed to be the commissioners, and any mortgagee or assignee may enforce payment of his principal and interest by appointment of a receiver.

The Public Works Loan Commissioners may, with the approval of the Commissioners of Her Majesty's Treasury, advance to a local authority, on the security of the local rate, without any further security, any sums of money to be applied for the purposes of this Act, and to be repaid, with interest, within any period as aforesaid.

Further power where expenses exceed one shilling in pound.

99. Where the estimated amount of the sum required to be levied for payment of the expenditure of a local authority in pursuance of this Act (including expenditure incurred in the payment of money borrowed or of interest thereon) exceeds the sum that would be raised by the levying of a rate of one shilling in the pound on the ratable value of the property assessed to the local rate, the local authority may borrow from the Public Works Loan Commissioners, and the Public Works Loan Commissioners may, out of the balance for the time being unapplied of any money by any Act already passed authorized to be issued for the purposes of loans under any Act repealed by this Act, or out of any other money for the time being authorized to be issued for the purpose of loans under this section, lend to them such sums as may be required, subject to the following conditions:—

1. Every such loan shall be made with the sanction of the Commissioners of Her Majesty's Treasury:
2. Interest shall be at the rate of three and a quarter per centum per annum:
3. Repayment of the loan shall be made by such number of equal annual instalments, not exceeding thirty, as the Commissioners of Her Majesty's Treasury direct:
4. The Commissioners of Her Majesty's Treasury may, if they think fit, authorize the postponement, for a period not exceeding two years, of any payment of principal or interest becoming due within the first three years:
5. Repayment of the loan and interest shall be secured by a mortgage of the local rate, and it shall not be incumbent on the Public Works Loan Commissioners to require any other security:
6. The local authority shall have power to levy and shall levy rates requisite for the purpose of repaying the loan with interest:
7. The sanction of the Commissioners of Her Majesty's Treasury to the loan shall be conclusive evidence that it is authorized by this Act; and no objection shall be made by any ratepayer to the validity of any mortgage for the loan, or to the application of the proceeds of the local rate to the payment of the principal or interest of the loan:
8. The Commissioners of Her Majesty's Treasury may, by agreement with the local authority borrowing, commute into an equivalent annuity terminable at the time fixed for the liquidation of the annual instalments aforesaid, the payments secured by the mortgage or any portion of such payments.

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Provision for existing loans.

100. Where a local authority have borrowed money on the security of a mortage of the local rate, under any Act repealed by this Act, then (except as otherwise provided in this Act with respect to the county of Chester), notwithstanding any repeal in this Act, or any alteration made by this Act in the definition of a local authority or local rate, or any other thing in this Act contained, the local rate mortgaged shall continue to be the security for the money borrowed, as if this Act had not been passed; and in relation to the money so borrowed, the local authority which borrowed such money, and the local rate on which the same is charged, shall continue to be the local authority and the local rate under the Acts repealed by this Act, as if this Act had not been passed; and all provisions of Part II. of The Cattle Diseases Prevention Act, 1866, relative to expenses, and all the provisions of The Cattle Diseases Prevention Amendment Act, 1866, and all other provisions of any Act repealed by this Act relative to expenses of local authorities, rating, remission of rates, and borrowing, and matters connected therewith respectively, shall, in relation to the money so borrowed, and to the rate charged therewith, continue to operate as if this Act had not been passed.

Provision for Cheshire as to repayment of existing loans, &c.

101. With respect to the county of Chester the following provisions shall have effect:—

(1.) As far as regards the expenditure of the local authority of the county of Chester in respect of principal of or interest on money borrowed in pursuance of any Act repealed by this Act, and any matter consequent on or relative to that expenditure (including the remission of rates), the foregoing provisions of this part of this Act shall not apply to that county;

(2.) That expenditure shall be defrayed out of the county rate for the county of Chester, or out of any money applicable under any Act of Parliament or otherwise for the public charges or uses of that county, or partly out of one and partly out of the other; such county rate to be assessed, levied, and collected in the manner prescribed by law for the assessment, levying, and collection of county rates, independently of this Act or of any Act repealed by this Act;

(3.) In lieu of any provision authorizing deduction by tenant from landlord of half of the local rate, any person who is not the owner of the premises in the county of Chester in respect of which he is rated to the poor rate may, in each year until the first day of November one thousand eight hundred and ninety-six, in which he duly pays his poor rate, deduct from the growing rent due to the owner of such premises a sum equal to one penny in the pound on the annual ratable value of such premises, and every owner shall allow such deduction accordingly; and the owner, for the purposes of this section, shall be the person defined as such in this part of this Act;

(4.) The local authority for the county of Chester shall entertain and decide on applications from ratepayers to whom, if this section had not been inserted in this Act, remission in respect of the local rate might have been granted, and may on such applications grant to the

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applicants, or any of them, such sum or sums of money (if any) out of the county rate as the local authority think reasonable, regard being had to the extent of loss in the cases of the several applicants;

(5.) The local authority of each borough situate within the county of Chester, and assessed to the county rate thereof, shall, by means of repayment out of the county rate, or by means of differential rates, or partly in the one way and partly in the other, be recouped the proportionate amount contributed by the borough to any money granted as aforesaid, so that the burden of the expenditure incurred by the local authority of the county in respect of such grants shall be borne wholly by the county, and not as to any part thereof by any borough situate within the county;

but nothing in this section shall prejudicially affect the mortgage security of the Public Works Loan Commissioners for money advanced to the local authority of the county of Chester under any Act repealed by this Act; and the local authority of that county shall from time to time levy such rates as are under this section applicable, and as are for the time being requisite (either wholly or in conjunction with such other money as in this section mentioned), for the purpose of repaying with interest the money advanced on such mortgage security according to the terms thereof.

Validity of rates under Act.

102. The existence of any order or precept for the making or collection under any Act repealed by this Act of any rate remaining uncollected wholly or in part at the passing of this Act shall not affect the validity of any rate made after the passing of this Act.

Part IX.—Offences and Legal Proceedings.

Penalty for disobedience to Act or Order.

103. If any person acts in contravention of or is guilty of any offence against this Act, or any order or regulation made by the Privy Council or a local authority in pursuance of this Act, he shall for every such offence (except as otherwise provided in this Act, and except where a less penalty is provided in any such order or regulation), be liable to a penalty not exceeding twenty pounds.

Where any such offence is committed with respect to more than four animals a penalty not exceeding five pounds for each animal may be imposed instead of the penalty of twenty pounds.

Where any such offence is committed in relation to offal, dung, hay, straw, litter, or other thing, a further penalty not exceeding ten pounds may be imposed in respect of every half ton in weight of such offal or other thing after the first half ton.

Penalties on use of expired licences, &c.

104. If any person does any of the following things he shall be deemed guilty of an offence against this Act:

(1.) If he does anything for which a licence is requisite under this Act, or any order of the Privy Council thereunder, without having obtained a licence:

(2.) If where such a licence is requisite, having obtained a licence in that behalf, he does the thing licensed after the licence has expired:

(3.) If he uses or offers or attempts to use as such a licence an instrument not being a complete licence, or an instrument untruly purporting or appearing to be a licence, unless he shows to the satisfaction of the justices before whom he is charged that he did not know of such incompleteness or untruth, and that he could not with reasonable diligence have obtained such knowledge :

(4.) If, with intent to evade any provision of this Act or of any order of the Privy Council thereunder, he fabricates or alters, or offers or utters, knowing the same to be fabricated or altered, any licence, declaration, certificate, or instrument made or issued or purporting to be made or issued under or for any purpose of this Act or any such order :

(5.) If, for the purpose of obtaining any licence, certificate, or instrument under or for the purposes of any such provision, he makes a declaration false in any material particular, unless he shows to the satisfaction of the justices before whom he is charged that he did not know of such falsity, and that he could not with reasonable diligence have obtained such knowledge :

(6.) If he obtains or endeavours to obtain any such licence, certificate, or instrument by means of any false pretence, unless he shows to the satisfaction of the justices before whom he is charged that he did not know of such falsity, and that he could not with reasonable diligence have obtained such knowledge :

(7.) If he grants or issues any such licence, certificate, or instrument, being false in any material particular, unless he shows to the satisfaction of the justices before whom he is charged that he did not know of such falsity, and that he could not with reasonable diligence have obtained such knowledge :

And in any such case he shall be liable, on conviction, in the discretion of the justices, to be imprisoned for any term not exceeding three months, with or without hard labour, in lieu of the pecuniary penalty to which he is liable under this Act.

Punishment for obstructing inspectors, &c.

105. If any person obstructs or impedes an inspector or other officer acting in execution of this Act or of any order of the Privy Council thereunder, he, and every person aiding and assisting him therein, shall be guilty of an offence against this Act, and the inspector or other officer, or any person whom he calls to his assistance, may seize the offender and detain him until he can be conveniently taken before a justice, to be dealt with according to law.

Application of penalties.

106. Notwithstanding anything in any Act relating to the metropolitan police, or to municipal corporations, or in any other Act, one half of every penalty or forfeiture recovered under this Act shall be paid to the person who sues or proceeds for the same, and the other half shall be applied as if this section had not been enacted.

Appearance of companies &c.

107. In proceedings before justices under this Act, any railway company or other body corporate may appear by any member of their board of directors or council, or by any officer authorized in writing under the hand of any director or member of the council of the company or body.

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Appeal.

108. If any party feels aggrieved by the dismissal of his complaint by justices, or by any determination or adjudication of justices with respect to any penalty or forfeiture under this Act, he may appeal therefrom, subject to the conditions and regulations following:

1. The appeal shall be made to some court of general or quarter sessions for the county or place in which the cause of appeal has arisen, holden not less than fifteen days and not more than four months after the decision of the justices:
2. The appellant shall, within three days after the cause of appeal has arisen, give notice to the clerk of the petty sessional division for which the justices act whose decision is appealed from of his intention to appeal, and of the grounds thereof:
3. The appellant shall immediately after such notice enter into a recognizance, before a justice of the peace, with two sufficient sureties, conditioned personally to try such appeal, and to abide the judgment of the court thereon, and to pay such costs as may be awarded by the court:
4. The court may adjourn the appeal, and may make such order thereon as they think just:

But nothing in this section respecting appeals shall affect any enactment relative to appeals in cases of summary convictions or adjudications in the city of London or the metropolitan police district.

Jurisdiction for trial of offences, &c.

109. For the purposes of proceedings under this Act, or any order of the Privy Council or order or regulation of a local authority thereunder, every offence against this Act or any such order or regulation shall be deemed to have committed, and every cause of complaint under this Act or any such order or regulation shall be deemed to have arisen, either in the place in which the same actually was committed or arose, or in any place in which the person charged or complained against happens to be.

Protection of Persons in execution of Act.

Actions against persons executing Act not to be brought without notice, &c.

110. An action or proceeding shall not lie against any person acting or intending to act under the authority or in the execution or in pursuance of this Act for any alleged irregularity or trespass or other act or thing done or omitted by him under this Act, unless notice in writing (specifying the cause of the action or proceeding, and the name and residence of the intending plaintiff or prosecutor, and of his attorney or agent in the matter), is given by the intending plaintiff or prosecutor to the intended defendant one month at least before the commencement of the action or proceeding, nor unless the action or proceeding is commenced within four months next after the act or thing complained of is done or omitted, or, in case of a continuation of damage, within four months next after the doing of such damage has ceased; and any such action shall be laid and tried in the county or place where the cause of action arose, and not elsewhere.

Plea in action.

111. In any such action the defendant may plead generally that the act or thing complained of was done or omitted by him

when acting or intending to act under the authority or in the execution or in pursuance of this Act, and may give all special matter in evidence.

Evidence in action.

112. On the trial of any such action the plaintiff shall not be permitted to go into evidence of any cause of action not stated in his notice.

Tender of amends, &c.

113. The plaintiff in any such action shall not succeed if tender of sufficient amends is made by the defendant before the commencement of the action; and in case no tender has been made the defendant may, by leave of the court in which the action is brought, at any time pay into the court such sum of money as he thinks fit, whereupon such proceeding and order shall be had and made in and by the court as may be had and made on the payment of money into court in an ordinary action.

Costs of defendant.

114. If in any such action the plaintiff does not succeed in obtaining judgment, the defendant shall receive such full and reasonable indemnity as to all costs, charges, and expenses incurred in and about the action as may be taxed and allowed by the proper officer, subject to review; and though a verdict is given for the plaintiff in the action, he shall not have costs against the defendant unless the judge before whom the trial is had certifies his approval of the action and verdict.

Costs, &c., of defence to actions, &c., under direction of local authority.

115. Where any such action or proceeding is defended under the direction or with the approval of the local authority, the costs, charges, and expenses incurred in and about the same by or on behalf of the defendant and payable by him, and any damages or other money recovered against or payable by him in or in consequence of such action or proceeding, shall be deemed expenses incurred by the local authority in pursuance of this Act and shall be defrayed accordingly.

Part X.—Scotland.

Application of Part X. to Scotland.

116. The provisions of this part of this Act shall extend to Scotland only, and shall have effect in substitution for the provisions of the preceding parts of this Act, when so expressed or implied, and otherwise shall have effect in addition to the provisions thereof.

Local authority, &c.

117. For the purposes of this Act the respective districts, authorities, rate, and officers described in that behalf in the ninth schedule to this Act shall be the district, the local authority, the local rate, and the clerk of the local authority.

Appointment of local authority in counties.

118. The commissioners of supply in every county shall meet, and nominate not fewer than four or more than fifteen of their number to act on the county board for the purposes of this Act, and shall intimate to the lord lieutenant of the county and the convener of the county the number and names of the persons so appointed.

The clerk of supply in each county shall call a meeting of the occupiers of agricultural subjects in such county, valued in the valuation roll in force for the time at one hundred pounds and upwards, and of occupiers of such subjects of which they are owners valued in the valuation roll at fifty pounds and under one hundred pounds; and such meeting shall be called by advertisement in one or more newspapers circulating in the county for

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the same day as, or for a day not later than eight days after the meeting of the commissioners of supply; and such advertisement shall specify the time and place of such meeting, and the clerk of supply shall be clerk to such meeting; and the meeting shall nominate from among such occupiers and owners and occupiers a number of persons equal to those nominated by the commissioners of supply, and the meeting shall also name a convener, who shall intimate the names of the persons so nominated to the convener of the county, and shall have power to call similar meetings by such advertisement, when occasion shall require; and in the event of such election not being intimated to the convener of the county within fifteen days from the date of such meeting, it shall be lawful to the lord lieutenant to nominate from among such occupiers, or owners and occupiers, such number of persons, and intimate the same to the convener of the county.

Any such nomination and intimation made for the purposes of any Act repealed by this Act shall continue to have effect for the purposes of this Act.

Vacancies from time to time happening by death, resignation, or otherwise among the members of the local authority shall be filled up by the authority and in the manner by and in which the members vacating office were respectively nominated.

The persons nominated as in this section provided, and the lord lieutenant of the county, the convener of the county, and the sheriff of the county (or in his absence such one of his substitutes within the county as he directs by writing under his hand), for the time being, shall constitute the local authority; five shall be a quorum of the local authority.

As far as not otherwise provided by this Act, such local authority shall have all the powers conferred on the local authority by this Act, and shall have power to elect a chairman, specify a quorum, and make all regulations necessary for carrying the purposes of this Act into effect.

The chairman of the local authority, and in default of him the convener of the county, and in default of him any three members of the local authority, may at any time call a meeting of the local authority, to be held at such time and place as he or they may fix, and the local authority may adjourn as they from time to time think fit.

Purchase under provisional order.

119. Part VII. of this Act shall have effect as if section ninety of The Public Health (Scotland) Act, 1867, were thereby applied, instead of section seventy-five of The Local Government Act, 1858, and in the said section ninety the local authority and local rate under this Act shall be substituted for the local authority and the assessment therein mentioned.

Mode of levying and recovering assessments.

120. The local authority in a county shall from time to time give notice to the commissioners of supply of the sums necessary to be provided under the provisions of this Act by means of the local rate; and the amount so intimated shall be assessed and collected by the commissioners of supply according to the real rent of lands and heritages as appearing on the valuation roll in force for the year, who shall pay over the same to the local authority.

The local authority in a burgh shall in like manner assess and

collect the amount required to be raised by local rate within such burgh.

All such assessments shall be payable one half by the proprietor and one half by the tenant, but may be collected wholly from the tenant, who shall in that case be entitled to deduct one half thereof from the rent payable by him to the proprietor; or wholly from the proprietor, who shall in that case be entitled to relief against the tenant for one half of the assessment; and for the purposes of the provisions of this Act relative to any balance of funds remaining over from any assessment, the words "local rate" shall in Scotland mean the poor rate.

All the provisions in regard to the recovery of assessments in the Act of the session of the twentieth and twenty-first years of Her Majesty (chapter seventy-two), "to render more effectual the police in counties and burghs in Scotland," are hereby incorporated in this Act as far as the same are not inconsistent with the provisions of this Act.

Certificate of copy for evidence.

121. In the case of a county, a printed copy of an order or regulation of the local authority, purporting to be certified to be a true copy by the clerk of supply, shall be received in proof.

Jurisdiction under 27 & 28 Vict. c. 53.

122. The terms "justice" and "justices" shall include any magistrate having jurisdiction under The Summary Procedure Act, 1864.

Local authority may apply to procurator fiscal.

123. In the event of any person refusing or delaying to comply with the order of a local authority, the local authority may give information thereof to the procurator fiscal of the county or burgh, who may apply to the sheriff for a warrant to carry such order into effect, and such warrant may be executed by the officers of the court in the usual way.

Sheriff to have concurrent jurisdiction.

124. All judicial powers given to justices and quarter sessions, or to magistrates in boroughs, by this Act, may also be exercised by the sheriff of the county or the sheriff substitute.

Notice of appeal.

125. Notice of appeal and of the grounds thereof shall be given to the clerk of the peace of the county.

Burgh of Maxwelltown.

126. For the purposes of this Act the burgh of Maxwelltown shall be held to be a part of the stewartry of Kirkcudbright, and not of the parliamentary burgh of Dumfries.

SCHEDULES.

The FIRST SCHEDULE relates to Acts repealed.

The SECOND SCHEDULE refers to the Local Authorities, &c., in England.

District of local authority.	Description of local authority of district set opposite name.	Local rate.	Clerk of local authority.
Counties except the metropolis.	The justices in general or quarter sessions assembled.	The county rate, or rate in the nature of a county rate.	Clerk of the peace.
The metropolis (subject to the provisions of this Act respecting the city of London and the liberties thereof).	The Metropolitan Board of Works.	Rate or fund applicable to the payment of the general expenses of the board.	The clerk of the Metropolitan Board of Works.
Boroughs - - -	The mayor, aldermen, and burgesses acting by the council.	The borough fund or borough rate.	Town clerk.
	Where the borough is not subject to the Act of the session of the fifth and sixth years of the reign of King William the Fourth, chapter seventy-six, the commissioners or other body maintaining the police therein.	The rate applicable by the commissioners or other body to the maintenance of the police.	Clerk of the commissioners or other body.
District of local board of Oxford.	The local board - -	Rate leviable by the local board.	Clerk of the local board.

The THIRD SCHEDULE contains Regulations respecting Committees and Sub-Committees.

"1. A committee formed by a local authority may consist wholly of members of the local authority, or partly thereof, and partly of such other persons being rated occupiers in the district and qualified in such other manner as the local authority determine.

"2. A committee of a local authority and a sub-committee of an executive committee may elect a chairman of their meetings.

"3. If no chairman is elected, or if the chairman elected is not present at the time appointed for the holding of a meeting, the members then present shall choose one of their number to be chairman of the meeting.

"4. A committee or sub-committee may meet and adjourn as they think proper.

"5. Every question at a meeting of a committee or sub-committee shall be determined by a majority of votes of the members present and voting on the question, and in case of an equal division of votes the chairman shall have a second or casting vote."

The FOURTH SCHEDULE refers to Regulations that may be applied to the landing, movement, and disposal of Foreign Animals.

"1. These regulations are to have effect with respect to those foreign animals to which they are from time to time applied by order of the Privy Council.

"2. Those foreign animals are to be landed only at parts of ports defined by special orders of the Privy Council for the several ports as places where foreign animals may be landed.

"3. They are to be landed in such manner, within such times, and subject to such supervision and control as the Commissioners of Customs from time to time direct.

"4. The owner, consignee, or other person landing them is either before landing them or within twelve hours after landing them, at his own expense, to mark them as follows:—in case of cattle, by clipping the hair off the end of the tail, and in such further manner (if any) as the Privy Council from time to time prescribe, and in case of other animals in such manner as the Privy Council from time to time prescribe.

5. They are not to be moved from the place of landing or lairs adjacent thereto, approved by the Privy Council, except as follows:

(*a.*) After the expiration of twelve hours from the time of landing or such other period as the Privy Council from time to time prescribe.

(*b.*) On a certificate from the veterinary inspector appointed in this behalf by the Commissioners of Customs certifying that they are free from contagious or infectious disease.

6. They are not to be moved alive out of the part of the port of landing from time to time defined in that behalf by the Privy Council.

7. Notwithstanding anything in these regulations, where a vessel comes into port having on board foreign animals maimed or injured on the voyage, the owner, consignee, or other person in charge thereof, or the master of the vessel, shall, if directed by the veterinary inspector aforesaid, or may if he thinks fit, slaughter those animals or any of them immediately on their being landed; but the carcase, hide, skin, hair, wool, horn, hoof, or offal of any such animal or any part thereof is not to be moved from the place of landing, or some lair or slaughter-house adjacent thereto approved by the Privy Council, without a certificate from the veterinary inspector aforesaid certifying that it is not likely to introduce or spread contagious or infectious disease.

THE FIFTH SCHEDULE has reference to the Tolls and Dues levied in the Metropolitan Market after opening of Foreign Cattle Market.

Sheep, per head - - - -	Five farthings.
Beasts, per head - - - -	Sixpence.
Calves, per head - - - -	Threepence.
Pigs, per head - - - -	Five farthings.

THE SIXTH SCHEDULE contains "Rules with respect to infected places."

PART I.—CATTLE PLAGUE.

1. The rules of this part of this schedule are to have effect with respect to infected places as regards cattle plague.

2. No animal is to be moved alive out of an infected place.

3. Any hide, skin, hair, wool, horn, hoof, or offal of any animal, or any

part thereof, is not to be moved out of an infected place without a licence signed by an officer of the local authority appointed to issue licences in that behalf, certifying either that the thing moved has not formed part of an animal affected with cattle plague, or if an animal that has been in the same shed or stable, or in the same herd or flock, or in contact with an animal so affected, or that the thing moved has been disinfected.

4. The carcase of an animal, or a single portion of raw meat weighing more than twenty pounds, is not to be moved out of an infected place without a licence signed by an officer of the local authority appointed in that behalf, certifying that the carcase or meat moved is not the carcase or part of the carcase of an animal affected with the cattle plague.

5. Any dung of animals, and any hay, straw, litter, or other thing commonly used for food of animals or otherwise for or about animals, is not to be moved out of an infected place without a licence signed by an officer of the locality appointed in that behalf, certifying that the thing moved has not been in contact with or been used for or about any animal affected with cattle plague, or that it has been disinfected.

Part II.—Sheep-pox.

1. The rules of this part of this schedule are to have effect with respect to infected places as regards sheep-pox.

2. No sheep is to be moved alive out of an infected place.

3. Any skin, wool, horn, or hoof of any sheep, or any part thereof, is not to be moved out of an infected place without a licence signed by an officer appointed by the local authority to issue licences in that behalf certifying that the thing moved did not belong to any forming part of a flock affected with sheep-pox, or to any sheep that has been on a farm or place in which that disease existed.

4. Sheds and places used by sheep affected with sheep-pox are forthwith after being so used to be cleansed and disinfected.

The Seventh Schedule contains "Pleuro-pneumonia Rules."

1. These rules are to have effect with respect to any field, stable, cowshed, or other premises infected by pleuro-pneumonia.

2. Cattle affected with pleuro-pneumonia are not to be moved from such field, stable, cowshed, or other premises, or from any land or building contiguous thereto in the same occupation, except for immediate slaughter, and according to regulations to be from time to time made by the local authority for insuring such slaughter.

3. Other cattle are not to be moved from such field, stable, cowshed, or other premises, or from any land or building contiguous thereto in the same occupation, except for immediate slaughter, without a licence signed by an officer of the local authority appointed to issue licences in that behalf certifying that the cattle moved are not affected with pleuro-pneumonia, and have not been in the same shed or herd, or in contact with cattle so affected.

4. Sheds and places used by cattle affected with pleuro-pneumonia are forthwith after being so used to be cleansed and disinfected to the satisfaction of the local authority.

THE EIGHTH SCHEDULE gives the Forms to be Used by the Inspector.

(1.)

Declaration of Disease.

The Contagious Diseases (Animals) Act, 1869.

I, *A.B.*, of , the inspector appointed by , being the local authority for the [county] of , hereby declare that I have this day found cattle plague [*or* pleuro-pneumonia *or* sheep-pox] to exist in the following field, stable, cowshed, or other premises, (that is to say), [*here describe the place where the disease is found*].

Dated this day of 18 .

(Signed) *A.B.*

(2.)

Notice of Declaration to Occupiers.

The Contagious Diseases (Animals) Act, 1869.

To *C.D.* of

I, *A.B.* of , the inspector appointed by , being the local authority for the [county] of , hereby give you notice, as the occupier of the following field, stable, cowshed, or other premises, (that is to say), [*here describe the place where the disease is found*,] that I have made a declaration, a copy whereof is indorsed on this notice [*copy of declaration as filled up and signed to be indorsed*], and that in consequence thereof * the field, stable, cowshed, or other premises aforesaid, with all lands and buildings contiguous thereto in your occupation, have become and are an infected place, and that the same will continue to be an infected place * until the determination and declaration relative thereto of the local authority, as provided for in section of the above-mentioned Act, [*or in case of pleuro-pneumonia omit the part between the asterisks, and insert* the pleuro-pneumonia rules of the above-mentioned Act will have effect in relation to the field, stable, cowshed, or other premises aforesaid.]

Dated this day of 18 .

(Signed) *A.B.*

(3.)

Notice of Declaration to adjoining Occupiers.

The Contagious Diseases (Animals) Act, 1869.

To *E.F.* of

I, *A.B.* of , the inspector appointed by , being the local authority for the [county] of , hereby give you notice that I have made a declaration, a copy whereof is indorsed on this notice [*copy of declaration as filled up and signed to be indorsed*], and that in consequence thereof the field, stable, cowshed, or other premises therein described, with all lands and buildings contiguous thereto in the same occupation, have become and are an infected place, and the same will continue to be an infected place until the determination and declaration relative thereto of the local authority, as provided for in section of the above-mentioned Act. And I hereby require you, as an occupier of lands and buildings adjoining to such infected place, part [*or* the whole] whereof lies within one mile of the boundaries of the infected place, to take notice that in consequence of the declaration aforesaid the rules of the said Act with respect to in-

fected places will, until such determination and declaration of the local authority as aforesaid, apply and have effect to and in respect of the land and buildings of which you are occupier as if the same were actually within the limits of the infected place.

Dated this day of 18 .

(Signed) *A.B.*

THE NINTH SCHEDULE refers to the local authorities, &c., in Scotland.

District of local authority.	Description of local authority of district set opposite name.	Local rate.	Clerk of local authority.
Counties, including any town or place which does not return or contribute to return a member to Parliament.	The persons appointed as provided in Part X. of this Act.	Rate appointed to be levied in Part X. of this Act.	Clerk of supply.
Burghs which return or contribute to return a member to Parliament.	The magistrates and town council.		Town clerk.

THE END.

BILLING, PRINTER, GUILDFORD, SURREY.

BSB Bayerische StaatsBibliothek
MDZ Münchener DigitalisierungsZentrum Digitale Bibliothek

Fleming, George,

A manuel of Veterinary sanitary science and police by George Fleming. with illustrations

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